POPULAR AVIATION

Including SOUTHERN AVIATION and AERONAUTICS

A MAGAZINE FOR THE PROMOTION OF PRIVATE FLYING AND COMMERCIAL AVIATION

Volume XXI | DECEMBER, 1937 | Number 6

TABLE OF CONTENTS

FEATURE ARTICLES

An Airy Chat with the Editor 8
The Story of the Amphibian 11
Canada's Largest Aviation Center 15
Cadet Days at Randolph Field 18
Sea Shots 21
"I Fly The Pacific to Hongkong" 22
An Airliner Turns Bomber 26
". . . Clear and Unlimited" 29
Automatic Flight—an Air Corps Achievement 32
A Preview of the Douglas DC-4 35
Bail Out! 37
New Fighters for the Army 38
Just How Tough Are Our Commercial Ships? 40
"They Said I Couldn't Fly" 45
Planes to Come 48
Personalities 51
Build Yourself a Baby Blimp 52
The Man Under the Hood 55
Aviation, Blondes and Lingerie 57
The National Air Board Says 58
The Latest in Aviation Inventions 59
More on Landing Gear Design 61
A Rotor-craft Symposium 62
Beams and Bending Moments 63
Build Art Chester's "Jeep" Racer 64
Uncle Sam's Newest Eagle 67

PICK OF THE BRIEFS

Coast Guard Flying and Radio 16
A Proud Old Bleriot 16
Lufbery's Compass 20
WPA Aviation Classes 20
Lightplane Engine Cowling and Bracing 24
Snakes and Planes Don't Mix 24
Our Front Cover: the Boeing B-17 28
Letters 28
Remember the Jenny? 30
A Few Words on the Junkers Diesel 34
The Frieze "Weatherman" 44
Sidelights on the Valve Situation 46
This Gas Model Ban 50
Useful Prop Kinks for the Amateur 54
Locates the Center of Gravity 56
How Do You Pronounce that Name? 56

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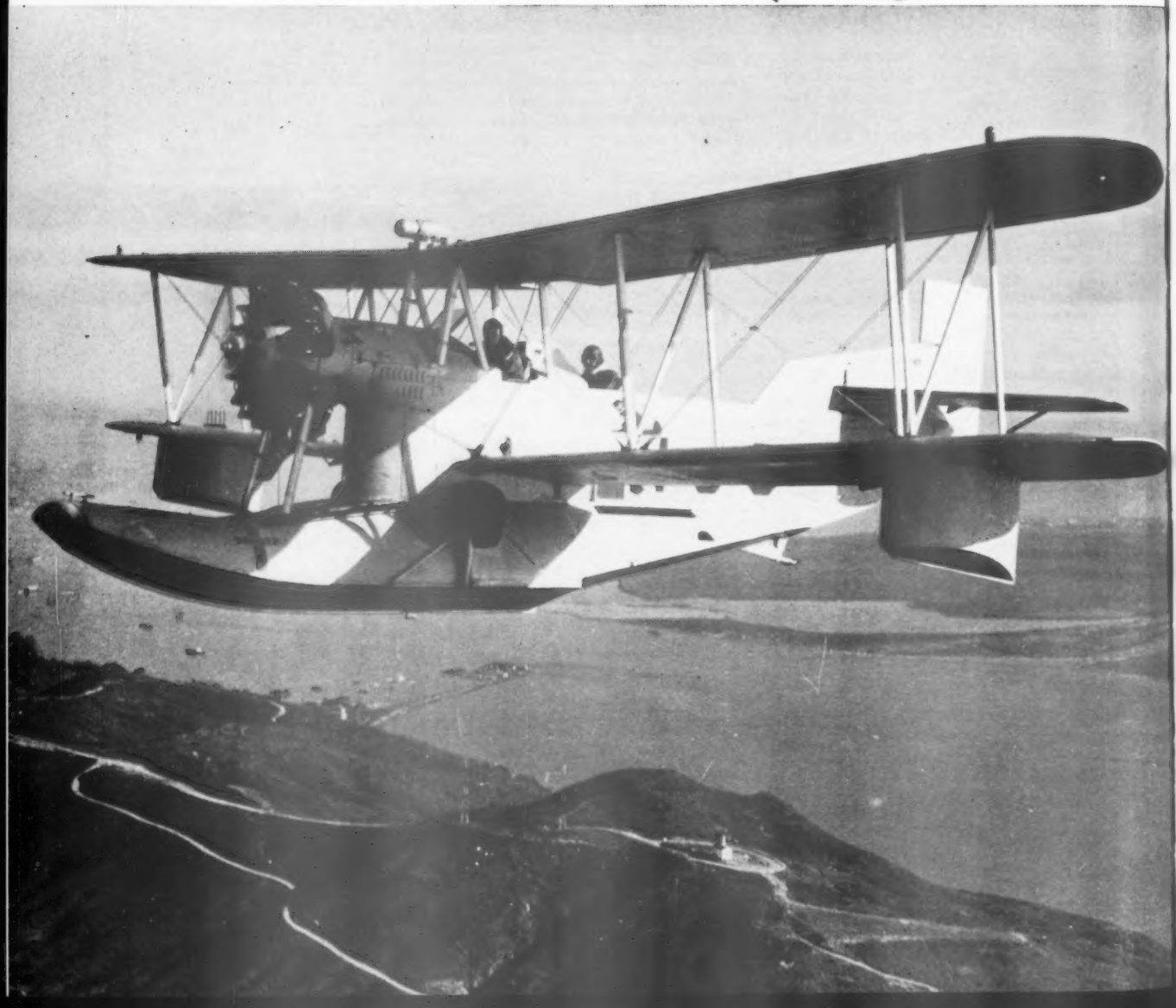
POPULAR AVIATION, Volume 21, Number 6, December, 1937. Published monthly by Ziff-Davis Publishing Company at 608 South Dearborn Street, Chicago, U. S. A. William B. Ziff, Publisher; B. G. Davis, Editor; John B. Rathbun, Managing Editor; Swanee Taylor and Max Karant, Associate Editors. New York Office, 381 Fourth Ave., New York City. Subscription $2.50 per year, single copies, 25 cents; foreign postage, $1.00 per year extra except Canada. Contributors are especially advised to retain copy of their contributions, which must be accompanied by return postage. All such material will be handled with reasonable care, but this magazine assumes no responsibility for its safety. Any copy accepted is subject to revision or changes to meet the requirements of this publication. Payment for copy used will be made at our current rates upon publication and photos and drawings will be considered as constituting a part of the manuscript in making payment unless otherwise specified. Entered as second class matter, January 24, 1933, at the Post Office, Chicago, Ill., under the act of March 3, 1879.

Sikorsky S-43.

The Story of the

Keystone-Loening.



This Seversky holds its class speed mark.

Amphibian

by ROBERT H. RANKIN

The most ideal all-round airplane is undoubtedly the amphibian. The birth and growth of this comparatively ungainly type is told here.

THE fact that the amphibian airplane is unlimited in its scope of operation makes it a most important factor in any consideration of the practical application of aviation. Its ability to be flown equally well off either land or water gives to it the advantages possessed by both the airplane and the flying boat. This of course makes the amphibian an important unit in commercial air transportation, as well as in military and naval operations.

Although the idea of amphibious aircraft is by no means new, the design and development of amphibians has been rather slow.

It is quite probable that the idea of aircraft which would fly from both land and water was first brought out as far back as 1898 by Ader of France. However, it was not until 1907 that anything practical was done. At that time the Wrights fitted a canoe between the runners of one of their pusher biplanes and Wilbur flew it at the Hudson-Fulton Celebration in New York City. Glenn Curtiss later fitted a canoe to his *Hudson Flyer* for his famous flight down the river from Albany to New York. No attempt was made to take off or land on the water with either of these machines.

From 1907 to 1911 several attempts were made in Europe to build a practical amphibian, but in every case the design was either a landplane fitted with floats or a seaplane set up on wheels. In all of these designs the original flying qualities of the aircraft were greatly impaired by the conversion. During the latter part of this period Curtiss successfully developed the seaplane and the flying boat and it is interesting to note that some of the models were equipped with wheels so that they could be rolled up on beaches. Curtiss did not attempt to fly these craft from land.

The first successful amphibian was brought out in 1912 by the famous French pioneer, Caudron. The Caudron amphibian was a twin-float biplane with a wheel mounted in a slot in the underside of each float just back of the step. This landing gear permitted the ship to take off and land on either water and land while at the same time it did not impair the flying qualities of the machine. Built as a two-seater and powered with the 80 h.p. rotary Gnome, the Caudron proved to be a very good plane and it was produced in limited quantity for the French government.

The World War with its emphasis on fast pursuits and heavy bombardment planes put a decided stop to the development of amphibian design. With the end of the War, however, there was a distinct revival, particularly in this country.

During the latter part of the year 1918 Lawrence Sperry gave serious consideration to the various problems of amphibian design. It was his belief that the lightplane could not become popular until it could be built to operate from land or water with equal ease. To this end he built a triplane amphibian.

This craft with its flying boat hull was the first aircraft to successfully employ folding gear and it was the first successful American amphibian. Powered with a Liberty 12, the craft had a high speed of 85 m.p.h. and a service ceiling of 9,000 feet. The machine was not very maneuverable and it had serious structural defects, but it was the first craft of the type to be developed along truly scientific lines.

In 1922, the U. S. Navy became actively interested in the possibilities of the amphibian and experiments were made using a Loening monoplane seaplane. Wheels were fitted into the pontoons of the machine, an arrangement which proved satisfactory in so far as landings were possible on both land and water. However, when the craft was used as a landplane the floats were of no value and when used as a seaplane the wheels seriously impaired the floats to the extent that the craft was nothing but a seaplane mounted on wheels.

At this time, Grover Loening became interested in the problem and work was started on the design of the first of the now-famous Loening amphibians. Actual construction of the machine was not undertaken due to the fact that the design called for an inverted engine and, although Loening had suggested the idea and possibilities of an inverted power plant to McCook Field engineers in 1919, nothing had ever been done about it.

While Loening was working on this design, Col. V. E. Clark designed a rather interesting amphibian which the Dayton-Wright Company built for the Navy. In general this ship was simply a conventional biplane type seaplane with folding wheels fitted to the pontoons.

In the meantime European designers had been devoting their attention to the problems. The first real step forward on the other side of the Atlantic was the development of the Vickers *Viking*. This flying boat type was equipped with a retractable landing wheel arrangement and it had a wing spread of 50 feet. Powered with a 450 h.p. Napier *Lion* water-cooled engine it could reach a top speed of some 105 m.p.h.

Some attention was also paid in England to the pontoon-type amphibian and the Fairey concern brought out a craft

Probably the most famous of all the early "ducks" was the Loening amphibian. For a while, it was the only successful amphibian on the market and served the Army, Navy, Marines and commercial companies equally well. The ship later became the Keystone-Loening. Many of these are still in use.

Donald Douglas originally intended the above ship for the sportsman-pilot. Curiously, though, the Dolphin found its immediate and lasting success as part of the flying force of the military services. Few are private ships.

Grumman amphibians like that shown below are an important and hard-working part of the United States' military forces today. Used only as a utility ship in the Navy and Marines, several models of this ship are used.

of that type as a deck-landing amphibian for the British Navy.

By the latter part of 1923 McCook Field engineers had perfected the inversion of the Liberty 12 and the early part of the following year it was used in the new and radically different Leoning amphibian. This craft, unlike any other amphibian, was neither land plane or seaplane. A *genuine* amphibian development, it incorporated all the flying qualities of airplane, flying boats and seaplanes.

Essentially, the Loening design embodied the changing of a tractor biplane into a flying boat by inverting the engine and building the fuselage as a flying boat hull. Thus, there was no useless waste of weight through duplication. It was at first thought that owing to the great depth of the body of the craft that the resulting low center of gravity would cause the machine to overbank. This difficulty was taken care of without the use of an abnormally large fin by carefully distributing all weights and by making the center of gravity and the center of the lateral fin area coincide just as nearly as possible.

Powered with a 400 h.p. inverted Liberty, the original Loening could fly circles around a DH and at the same time it could function equally as well as either a seaplane or a landplane. The machine had a top speed of 124 m.p.h. and a service ceiling of 15,000 feet. It proved to be so successful that it was built in quantity for both the Army and the Navy. Since that time the Leoning amphibian has been standard service equipment.

Over in France during this time designers were still working on the problem and the year 1926 saw the production of the Schreck FBA-21. This craft was a biplane flying boat fitted with wheels which folded up under the wings. It was powered with a 450 h.p. Hispano-Suiza which turned a tractor propeller. The high speed of the craft was around

109 m.p.h. Although the Schreck could alight on either land or water it could not be regarded as a true amphibious development due to the fact that a close examination of the design reveals that it was simply a normal flying boat to which wheels had been added.

In 1925, Igor Sikorsky began the development of his amphibians and the following year he brought out the first of the now famous Sikorsky amphibians. This machine, the S-36, was the first to have a short cabin hull and it was also the first Sikorsky to have the tail surfaces mounted on outriggers. Like the later developed and better known S-38, the craft was a biplane type and the wheels folded back under the wings.

In the S-36, the engine nacelles were mounted up in the leading edge of the top wing. Powered with two 300 h.p. Wright J-6 air-cooled engines it could carry a pilot and six passengers at a speed of about 100 m.p.h. The craft showed good characteristics as both a seaplane and a landplane and it marked the first original amphibian design since the Loening.

In 1927, a refined and modified model of the S-36 was brought out. This was the S-38. It found instant success, being used in quantity by Pan American Airways. Many ships of the type were also built for the Army, Navy and private operators. The S-38 was a ten-place job powered with two 420 h.p. Pratt & Whitney engines. These engines were mounted in nacelles which were slung between the wings and they gave the machine a high speed of over 130 m.p.h.

During the period from 1928 to 1931 three more Sikorsky amphibians were brought out. These were all quite similar to the S-38 in that they were short hull cabin types with the landing wheels folding back or rather up. In each of the three models the tail surfaces were

The mention of the word "amphibian" today usually brings the name Sikorsky immediately to mind. Long famous for building this type of airplane, Sikorsky's most famous model was the S-38 shown above. This model saw service in all corners of the world. It was powered with two Wasp engines.

When Sikorsky turned out the above model (S-39) for a private market that wanted a ship with all the features of the S-38 at the top of the page, he (unlike Douglas and his Dolphin) managed to sell a few. But not many.

The neat little job below is the reliable old Vought "Corsair" rigged up with a special amphibian landing gear. Originally a seaplane that the Navy launched by catapult, the amphibian gear was only an afterthought.

mounted on the familiar outriggers. The first of these machines was the S-39, a four-place job powered with a single 350 h.p. air-cooled engine.

The next craft was the S-41. This twelve-place amphibian was equipped with two 575 h.p. P & W *Hornets* which gave it a high speed of some 131 m.p.h. The last and largest of this particular triad of amphibians was the S-40. This craft, the largest amphibian ever built, was produced for Pan American and its four 575 h.p. *Hornets* gave it a high speed of 130 m.p.h. The S-40 is the first of the now famous *Clippers*.

These 38-place jobs are still in active service on Pan American's South American routes. It is interesting to note that these three models were designed with the engine nacelles slung below the wing and incidently they began the present Sikorsky trend to the high-wing monoplane type.

During this same period the Loening design had been modified and the craft were being powered with air-cooled power plants. It should be stressed here that the Loening design was the first to provide for the folding of the landing wheels into hull. Loening did depart from this particular practice in the Keystone-Loening *Commuter* of 1930, however. This biplane flying boat type was fitted with a landing gear which simply folded up under the wings. The craft was powered with a 300 h.p. engine.

About this time the Vought concern brought out an amphibian which was quite similar to the conventional *Corsairs* of the time except for the fact that the machine was provided with landing wheels which folded back into the single pontoon.

During the year 1930 there was considerable activity in the production of amphibians with many of the major aircraft manufacturing concerns turning out amphibian types. In spite of the great number of different makes, however, there was very little new and original about these machines. For the most part they were simply flying boats and seaplanes redesigned and modified to use wheels.

Among the craft brought out at the time were the Iceland *Privateer*, N-2-B, N-2-C, and the American Aeronautical Corporation's S-56. The *Privateer* was powered with a Warner *Scarab*, the N-2-B used a 300 h.p. Wright *Whirlwind* and the N-2-C used a 420 h.p. P & W *Wasp*. The S-56 of the American Aeronautical Corporation was fitted with a Kinner K-5.

Fokker also entered the amphibian field during this period with his F-11. This craft was a monoplane job built about a conventional looking flying boat hull. The wheels were designed to fold under the wings. Powered with either the P & W *Hornet* or the Wright *Cyclone* it had a cruising speed of 100 m.p.h. and a high speed of 115 m.p.h.

The following year Douglas entered the field with his *Dolphin*. This monoplane job was also built about a boat hull. The wheels folded up out of the

(*Concluded on Page 70*)

How Many of These Ships Can You Name?

Fig. 1

Fig. 2

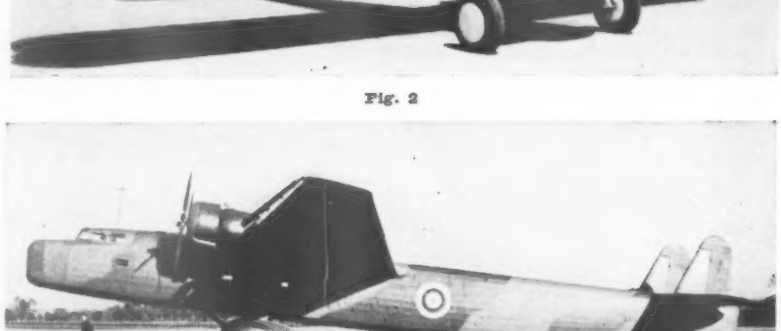


Fig. 3

Fig. 4

For correct answers—See page 86, column 2.

Canada's Largest Aviation Center

by HAROLD H. HILLIARD

Red Lake, while little known to the layman, is one of the busiest airports in America. In ten short years it has become the hub of most air services in Canada.

A LITTLE town of 1,200 souls, hub of mining activity which supplies a total of 3,000 persons with their daily bread, back in the deep forest wilderness of Canada's farthest north frontier—the town of Red Lake, in Northwestern Ontario, close to the Manitoba boundary, is Canada's busiest airport. In addition, Red Lake, according to 1936 statistics, claims the distinction of being second only to Newark as the world's most active plane base.

Center of a network of air services unequalled anywhere on the globe, Red Lake has sprung up in a period of ten years from a site of muskeg and rock to a bustling modern mining town, due primarily to the assistance of airplanes. It was the air machine which took the first loads of freight in for the first exploration crew during the fall of 1925, when the first gold find was made while, today, the plane is still recognized as the miner's best friend.

The past winter saw the ice-covered lake in front of Red Lake town—the only airport that most northern Canadian mining camps boast—literally covered with planes from daybreak to dark. This summer the machines, equipped with floats, land on the water as in previous years, only in much greater numbers than ever before.

Seldom, during the winter months, was there stillness on the ice-port at Red Lake as practically always the drone of a plane landing or taking off could be heard. Eighty movements was common during a day while often as high a figure as 130 movements was established. This represented 65 landings and as many take-offs which is a remarkable figure for a 12 hour day. Due to the lack of lighting, radio and beacon facilities in this country, it is impossible to fly during the dark, so movements are confined to the daylight hours.

Talking to Ernest Antilla, an air engineer who spent the winter in Red Lake, the other day, the writer was informed

This is the town of Red Lake, Ontario, whose mammoth airport is the aviation center of Canada. Activity at this field is said to be greater than Newark airport.

that, one night, Red Lake was the resting place for 16 planes. This is a remarkable feature when it is considered that Red Lake is merely a calling point. Generally all of the 20 to 30 great air freighters servicing this town spend their nights "outside" at railhead points, Hudson, Sioux Lookout, Kenora, Lac du Bonnet and Winnipeg.

As many as nine and ten planes, which range in size from those carrying payloads of only six to seven hundred pounds up to the 2½ ton Junkers single-motor monoplane, have often been seen sitting on the ice at Red Lake at one time.

Christmas last was a busy time for the air companies—I should have said a "wild" time as that best describes the situation, for most other times are busy periods. In some cases it was necessary to book passage in a plane a week ahead, so great was the demand by miners anxious to go home in Halifax, Winnipeg, Montreal, Minneapolis and other points for the festive season.

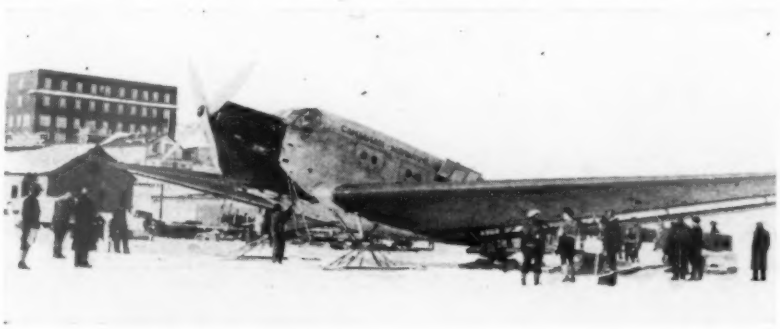
Under ordinary circumstances nine out of every ten planes coming out fly empty —usually the loads are all for "inside" not "outside," but at Christmas one of six companies regularly servicing this camp reported bringing out 87 holidayers in one day before the 25th while, on another occasion, 165 were handled.

Due to most of the demands on aeroplanes being for trips into the camp, rates are proportionately higher, to cover the cost of ships flying out empty. Passengers, mail and express flow in as fast as planes can move them but, on return trips, craft are usually empty. Occasionally a few passengers or a gold brick make up the load.

At present, the average rate from a railhead point, 100 miles as the crow flies south of the mine metropolis, is $36 return or about 18 cents per mile. The figure has been cut about in half recently by one company which now flies at 10 cents per mile. This is comparatively cheap as compared to the $1.50 per mile figure of 11 years ago, or what was commonly called the "$1.00 per pound days," as compared to five cents per pound now.

When the wartime Jenny, first and only machine to supply service to Red Lake during the gold rush of the winter of 1926, took a load from the track, one dollar was the charge on every pound to go in, whether it be a passenger, fish, mail, bag of flour, or butter. If a passenger, weighing up, discovered he couldn't make the next trip then had to go and eat a meal while waiting for the plane to return, it usually cost him a few extra dollars. After eating, it was necessary to weigh him again and, as often as not, five dollars was the additional charge.

Jack Hammell, the dean of Canadian prospectors, went fishing during the summer of 1926 and caught a 30 pound whitefish which he wished to display to his friends in Toronto. So he paid $30 in



Here is a reliable old Junkers monoplane on skiis at Red Lake airport. Canadian Airways planes like this are northern Canada's most-used means of transportation.

plane freight to bring the prize out to the railway. On another occasion, a contractor received delivery of two bags of oats. The pilot handed him a $200 invoice to cover freight charges.

After useless protests upon part of the contractor, the bill was paid, but, a few weeks later, he got his money back when his horses towed the plane to safety when the craft got stuck in slush on Red Lake. A bill of $200, for this service, was paid, also under protest.

Red Lake's bid for honors as one of the world's busiest airports all started because, in the fall of 1925, Jack Hammell hired planes of the world's first air fire-fighting service, that of the Ontario Provincial Air department, to transport freight and men into Red Lake because it was too late in the season to take them in by boat. It was the first time that anyone had been known to use aircraft in connection with mine freighting while, at the same time, it marked the beginning of commercial aviation in Canada.

A few months later, the wartime Jenny was brought to Hudson to give air service to Red Lake while, a year after, the foundations of what is now Canadian Airways, the largest of the Dominion's air companies, were laid when a Fokker freighter arrived at Hudson to forever wipe out "dollar a pound" air rates.

Now, Red Lake greets planes with the nonchalance with which the average city dweller meets a railway train. There are children in Red Lake who were born and brought up who regard the plane as part and parcel of their life—which it is—but who look forward to the day when they can see their first steam engine.

Large shipments by air are becoming commonplace. Last summer a mining company east of Red Lake received 1,600,000 pounds of fuel oil and other requirements by air, due to the lack of other forms of transport, except winter tractor which was no cheaper than plane rates. This summer the same company will receive at least 2,000,000 pounds.

Another mining organization, north of Red Lake, had its complete mining plant transported a distance of 150 miles by air—a load of close to 400 tons. Literally speaking, a pile of freight in Winnipeg was taken by boat and then plane to be transplanted in the centre of Northwestern Ontario's wilderness to become a small modern mining town.

One air service recently completed the largest air shipment in Canada, 36,000 pounds, from Lac du Bonnet to Red Lake, a distance of 100 miles, in three days. Another company, as part of their routine work, flew a hockey team, including 15 players and officials out from Red Lake to Kenora (100 miles) one day and, after the team played two games for the mining district championship, flew back to the northern metropolis. Still a third air organization recently completed the shipment by air of 100,000 pounds of freight from Sioux Lookout to Red Lake (115 miles) in a period just under two weeks.

Unofficial figures show that, of the 25,000,000 pounds of freight handled by air companies in Canada during 1936,

(*Concluded on page* 75)

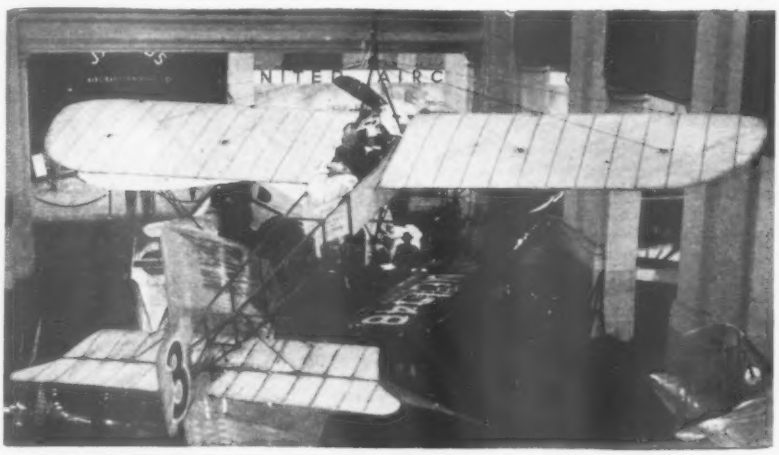
Coast Guard Flying and Radio

This Coast Guardsman can flash an immediate SOS to his base from this airplane.

UNCLE SAM'S flying Coast Guardsmen are probably the least-publicized of our flying forces—and probably the most colorful. Once in a great while, an enterprising newspaperman digs up one or two heroic rescues and missions of mercy performed by a Coast Guard airman. But these cases are comparatively rare. The above photograph shows part of the elaborate equipment maintained aboard the ready-and-waiting Coast Guard amphibians. When disaster strikes, these men work the hardest—and right in the thick of it. Radio calls for help by ocean-going steamers is sure to bring the Coast Guardsmen alongside

A Proud Old Bleriot

HANGING proudly from the ceiling of New York's recent aircraft show, the old Bleriot Type 11 "cross-channel" airplane looked down on many a modern airplane with a fatherly air. One of the American-type Bleriots that gave many a present-day airman his first taste of flying, this ship is practically in as good condition as it was back in the days when it was flown at New York's Hempstead Plain. Basically, there is little that is different about this majestic but of aeronautical history from the sleek new Bellanca that can be seen beneath it. Except, perhaps, the addition of ailerons on the newer ship. The Bleriot's wing-warping wires can be seen in the picture. That the ship is hardy and rugged despite its rather naked appearance, is evidenced by the fact that the propeller was swung by a Gnome rotary motor.



The old Bleriot drew much attention as it hung in its place of honor at the exhibit.

GRUMMAN F3F-2

CADET DAYS AT

by MAC DONALD H. HAYS

In past installments the author, a flying cadet at Randolph Field, has told of his many experiences as a "mister". In this (his third) article, Hays goes on Nine-S, a tough mission.

HERE comes Duncan in No. 216. Well, he's coming in at 500 ft. anyhow. He makes his last turn, levels out and there go the flaps down. He is overshooting slightly so he rolls down more flaps. Boy! His ship comes down fast in a steep glide. Wham! wham, wham—a wheels-first landing with three bounces. Must have been doing close to 100 m.p.h.

A number of us who fly second period are watching the first period boys bring in their ships. It is the second week of flying the basic training North American ships. We all have four or five hours of dual instruction and many of the boys are soloing as the chap was who just came in "hot" and made the sloppy two-point landing.

Several more boys come in with their instructors and land. Well, let's just walk out of the ramp and look inside the cockpit and see what instruments and controls there are with which we must become familiar. I'll get in the front cockpit. O. K. On the left side here is the throttle, altitude mixture control and prop pitch lever—the forward position is for landing and taking off and back for cruising speeds. Directly underneath is the stabilizer wheel, the gas tank selector and the crank for rolling the flaps up or down. Eight turns of the crank puts the flaps down about half way or 30 degrees. On the right side is the compact radio with switches and microphone so that the instructor can talk with the student, and the student can talk to the control tower. Two flare release handles are located to the right of the seat. Straight ahead is, of course, the instrument board and underneath it is a panel with switches for navigation and wing lights.

Yes! You are right. There are several more things to think of than with the old PT-3—where we had the stick in one hand—throttle in the other and all our navigation instruments in the seat of our pants. In the BT-9 we have 200 more h.p., 100 gallon gas tanks—60 more than the PT, higher top speed and a longer cruising range.

Well, that's the story on the comparison of the primary and basic ships. It's like going from a rowboat to a motor launch. Small defects in flying which did not show up clearly on "A" stage become very apparent as soon as a faster ship is flown. Although instructors iron

The author (left) and his airplane (right) have much advanced flying in store for them.

RANDOLPH FIELD

out many of these points during the first month, several boys are washed out on their flying, but more go because they "just didn't use their heads." A wrong entry into traffic causing other ships to scatter, sloppy patterns around a field, neglecting to look around for other ships while in the air, all are classed as dangerous flying. A sign in our hangar reads:

"Keep your head and eyes moving constantly while in the air. Avoid air collisions. They are the worst type of accident. A pilot with a stiff neck has no business in the air."

It is our business during this month to absolutely familiarize ourselves with the instruments and controls in the ship. This comes in handy later on during our night flying. In the darkened cockpit we can find the propeller pitch control, stabilizer, or the flap handle, by feel.

Nine-S. This is the cross-country mission symbol. We are about to graduate from the familiar 26-S or local flying. Those of us in the first section arrive at the hangar at 7 a. m. This, our first cross-country, is to be a triangular course and we are to land at San Marcos, Austin and Gonzales. We plot our own courses on a map, and mark check points such as as railroads, rivers, lakes or highways every 15 to 20 miles.

The first cross-country trip goes off nicely. As we approach and locate the field we call in on the radio to the instructor on the ground. For instance if we are in ship No. 221 as we call in: "221 to 240, Flying Cadet Johnson requests permission to land. "Go ahead." The instructor then tells us to come on in and land or to circle the airport until it is clear.

One chap called in on his radio: "Sir, I am circling over the airport at 15,000 feet. Shall I come on in and land?"

The instructor replied: "Sure, come on in, but it might be a good idea to lose some of that altitude first."

Another time one of the fellows had asked to land. "O.K.," said the instructor on the ground, "but keep your eyes open. There are four ships circling up there." This gentleman strained his eyes, got on the edge of his seat—looked down, back and above—picked up his microphone. The instructor heard a worried voice says:

"Sir, I have only been able to locate three ships."

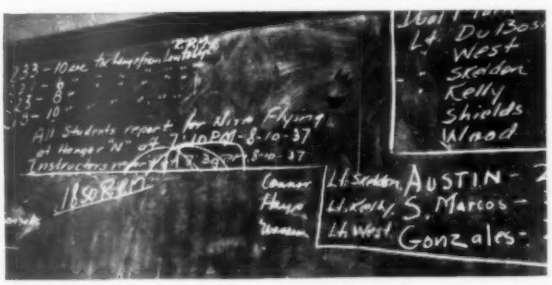
The instructor grabbed his mike:

"Sure you only see three ships. You're in the fourth."

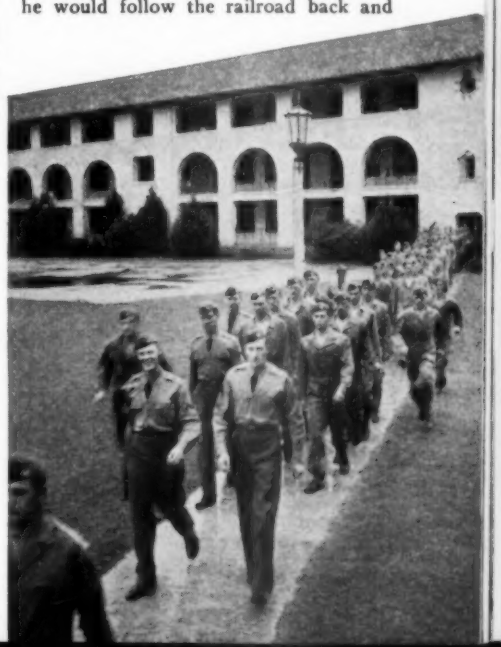
The radio helmets fit very tightly and at a time like this you have absolutely no trouble hearing.

Before our second cross-country to Ft. Clark we got a talk from the flight commander. "This field," he said, "is located just 25 miles from the Mexican border. Now I don't want anybody getting lost over in Mexico. You've got a compass—use it. But if anybody should get lost, just keep right on going because it's a washout offense."

We leave. We get back. Everybody but Jim Fields. He arrived at Ft. Clark okay, but when he took off he thought he would follow the railroad back and



School is school, no matter where. Blackboards (left) and kiwis (right) are conspicuous.



see the sights. He was doing all right until he hit an open switch and continued on instead of turning left. He crossed the Rio Grande and headed straight into Mexico. When his gas ran low he headed back and landed near Piedras Negras just a couple of miles short of the border. Jim told us later that when he climbed out of his plane and upon asking his position heard the word "Mexico" —he turned white and was very unsteady. He got back O. K. after spending some time in jail because he had entered the country with no passport.

Cross-country hops are valuable training. Climb in the rear cockpit, connect your headphones and we'll go to Dallas today and see just what type of training we get on these short trips.

We call in to RT-5, the control tower, giving ship number, name of pilot, time schedule to depart. Circling above the field a few minutes later we set the ship on 23 degrees—a course which goes over Austin. Since we are flying east of north, our altitude is in *odd* thousands of feet above sea level. Coming back it will be *even* thousands of feet. We note time of departure and since Austin is our first check point at 60 miles, we estimate that we will pass over the town in 30 minutes or less—with our airspeed of 120 m.p.h. Okay, 26 minutes later we sight Austin a couple of miles to our left so a slight course correction is made. Waco, our next large town, is on a course of 13 degrees from Austin and the distance is approximately 93 miles.

This time let's climb up to 5,000, get some smooth air and use our altitude mixture control to save gas. In 28 minutes we check on the towns of Belton and Temple directly below and then in 15 minutes we sight the red Brazos river which goes through Waco. From Waco to Dallas our course is two degrees and we check on Hillsboro, Waxahachie and several railroads on the way up—arriving at Hensley Field just outside of Dallas in one hour and 40 minutes elapsed time. We call in, get permission to set her down and come on in and land, using the first third of the field. Our ship is gassed and we start back on the 240 mile trip.

Both on the trip up and back we have tuned our radio to get the Dallas and San Antonio weather reports which come on at ten, 15 and 29 minutes past the hour. We flew by way of Austin and Waco to avoid rough country which would make a forced landing dangerous.

Back at the barracks that evening we hear a number of stories concerning the trip. One boy was forced down—landed in a small field, jumped a fence to get into another field and finally stopped just short of a couple of large trees. The ship was not damaged but the field was so small that it could not be flown out. His landing caused great excitement and a couple of days ago he received a clipping from a paper in a nearby town describing his escapade. The clipping said in part:

"A huge army observation plane was forced down in Farmer Tutts' field Tues-

(*Concluded on Page* 74)

Lufbery's Compass

ONE of the least conspicuous but most impressive objects in the aircraft collection of the United States National Museum at Washington, is the compass of Major Raoul Lufbery, the noted Amercan World War Ace, who died in aerial combat, May 19, 1918.

The World War is long since ended; aviation has developed, aerial tactics have changed. Military strategists tell us that the day of the lone flying hero is over, that air fighting is a matter of "operations" rather than individual exploits.

When viewed through the mists of the intervening years, the deeds of the war flyers of 1914-1918 seem almost legendary like the stories of Sir Galahad or the Cid. But, giving verification to the name of Lufbery and the realization that this great hero lived—and died—gloriously, there remains this relic, enshrined among the treasures of aeronautic history: the compass of Lufbery.

To the modern transport pilot whose duty lies in flying safely and accurately

One of the German bullets that sent Luf falling to his doom smashed his compass.

to his destination carrying mail and passengers on a rigid schedule, a compass is an indispensable instrument. But it is probable that on Lufbery's last flight, the great ace scarcely glanced at his compass as he climbed to engage an audacious enemy who had dared to fly near the American airdrome.

Meanwhile the compass mutely performed the operations of swinging to right and left as the pilot maneuvered for position; it heard the staccato bark of the guns, then, surprisedly instead of the exhilaration of victory, came the gush of heat and flame, a swerving turmoil of pilotless abandon, then a crash. Minutes later this compass was reverently taken from the smoking ruins of the little Nieuport plane which had carried the idol of America to immortality. It exists today to relate its story to those who visit the Shrine of Flight at Washington.

Gervaise Raoul Lufbery, a lover of adventure and travel, an example of bravery, audacity, and energy, and a remarkable pilot, was born in France, March 14,

(*Concluded on Page* 84)

WPA Aviation Classes

IN the summer of 1935, there sprang up in Illinois from various cities where educational projects were in the process of development, a question as to why aeronautics was not presented as a free educational subject along with other practical subjects.

So many inquiries appeared that the various project superintendents requested that instructors be hired or a separate project be made up and sent to the authorities in Washington for approval. The latter plan was followed twice but was disapproved finally.

Actors, sculptors, painters, clerks, bookkeepers, stenographers; teachers of English, history, Americanization, current events, sewing, knitting, manual training and so on were put on projects but nary an airplane mechanic, pilot or ground school instructor had been retained.

Let us say here that the very absence of them in one way can be credited to the soundness of the aviation industry as there were found no men trained in this field on the relief rolls. The proposition of building a small staff of instructors in the ten percent, non-relief quota was then undertaken by the writer at the suggestion of Walter Roy, supervisor of educational projects, and with the whole-hearted approval of Elwood Cole, secretary of the Illinois Aero Commission.

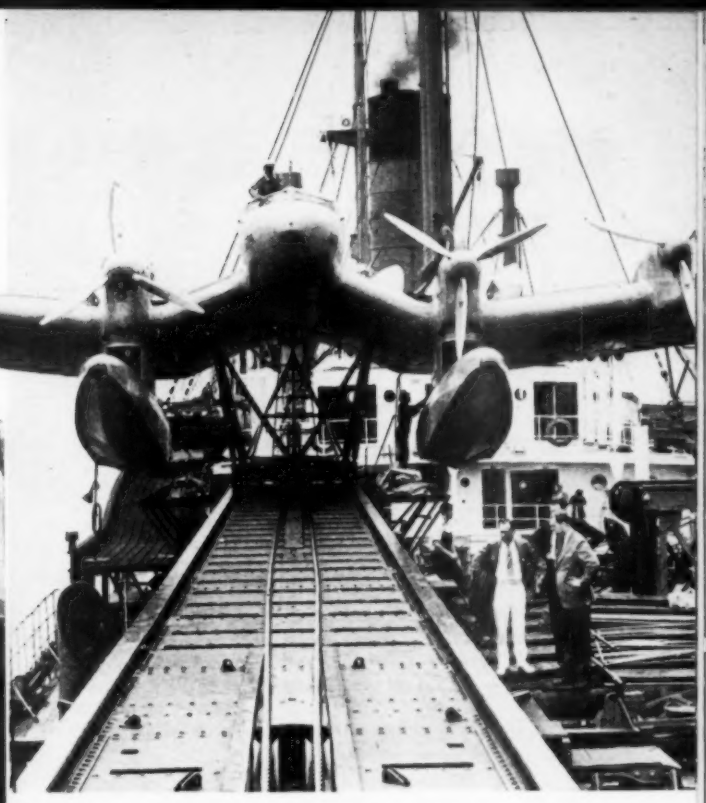
Three groups of students in widely separated sections of Chicago were given a 48 lesson theory course with no equipment other than a lighted classroom, blackboard and chalk. The results were highly gratifying and lead us to the conclusion that if such a public service could be worked out as a permanent institution both for a leisure time activity and to make our rising generations more correctly air minded that it would be a tremendous boon to the commercial operator.

Minimum restrictions of 16 years of age and two years of high school were impressed, with no financial obligation whatever. The attendance varied from 12 to 35, with about 15 percent women. The groups soon organized themselves into flying clubs and sought air instruction among the commercial operators, who were able to supply this mass training at very low rates. While not all students wanted flight training, at one time 60 persons from the three classes or clubs were flying regularly.

The flights were paid for by each person by use of a rather novel method. As their means were usually limited and they were all starting from the very beginning, it was agreed that each member who wanted to fly would pay in to the club treasury 30 cents per week and that, for each multiple of the cost of 15 minutes' flight, one name of a member would be drawn out by lottery for a flight the coming week. As each

(*Concluded on Page* 96)

Sea Shots



Luft Hansa's Captain Blankenburg (left) is shown at the controls of the big four-engined airliner. The ship is shown above on its catapult cradle.

THE CATAPULT JOINS THE MODERN AIRLINE

CATAPULTING transports into the air is something few experimenters have dared. But the European airline, Luft Hansa, has adopted the catapult—and quite successfully—as the means of launching its four-engined H. A. seaplanes which have been surveying the Portugal-Azores-United States trans-Atlantic airline during the past several months. The accompanying photographs show the *Nordmeer* on the catapult and being shot into flight. Luft Hansa now has two completely equipped "mother ships" stationed in the Atlantic to tend and catapult the airliners as they wing to and from the United States on the experimental flights. That the system is a technical success, at least, is proved by the fact that both the *Nordmeer* and her sister ship, the *Nordwind*, both have uneventfully crossed the Atlantic to the United States. However, no service is planned for the near future.

To catapult the "Nordmeer" in the picture below, the mother ship had to back into the wind and pick up speed. All in the airplane need head braces during the "shot".

I FLY THE

Here is one example of the work Pan American has done. This modern hotel is on Midway I.

Map Courtesy Official Aviation Guide

United Air Lines Captain Heber Miller gives the author a few pointers.

Now that this business of casually flying across the Pacific to China is running on a rather monotonous twice-weekly schedule, we thought you would like to "be in on" such a trip.

by VIOLET SWEET HAVEN

FLYING across the Pacific in the *China Clipper* brings speed to a complete halt, and the 9,000 miles of blue ocean are spanned as if by magic. In flight you hear motors, the *Clipper* moves through the sky, tips ever so gently, clouds slowly pass and wave formations appear on the water below. But there is no sense of speed.

It is as if you were riding in a carnival airplane with the motors humming but the toy plane making no progress. It may be likened to the cage of a blimp. You feel suspended from something substantial rather than confined in the single metal structure weighing 25 tons which zooms through the heavens at 150 m.p.h.

The *China Clipper* is glorious in its amazing construction and performance. So glorious that for the first time in many trips to Hawaii the islands lost their halo as I flew to them. Arriving by steamer, Hawaii is stupendous. Diamond Head is gigantic. The city of Honolulu is large, the streets are many, the water is green, the hills are high.

The *Clipper*, rising as it does to survey this vista while spanning the Pacific, dwarfs the mountains, shrinks Diamond Head, masses the city of Honolulu into its true size, reveals the green surf to be only a fringe of the mighty blue Pacific, and lends the thin strip of sand that is Waikiki its proper small scope in the beauty of the entire universe as seen only from the *China Clipper*.

After embarrassing the Paradise of the Pacific, the flying boat atoned by circling over Kokohead and around the coastline so that Oahu might preen its entire beauty. Now, for the first time, common man is permitted to scan Hawaii's charms at a glance. Just as in life we live more richly, so in the clipper ships do we now exact real beauty. No longer can a tiny strip of sand keep us rapt for long.

Out to sea from Honolulu, Oahu lost its peculiar charm and was to the clipper merely an enlarged Guam, an island in the Philippines or a part of the California coastline. Oahu seemed humble, like a person awaking from an illusion of his own importance.

Even clouds crept over the peaks of Honolulu in reverence to the *China Clipper* as she fled through the heavens. She seemed like a bird, courageous to the tip of her wings and optimistic with the backing of science, the elements and

This is a far cry from air travel of a comparatively few years ago. The luxurious compartment of an American Airliner (left) also contains two berths. One of the author's many special permits is shown in the inset below.

U. S. Form 37 — Guam, M. I. 20 Apr. 1937

No. 47

SPECIAL CAMERA PERMIT

Fee $.50 — Treasurer's No. _____

Violet Haven (Name) is hereby licensed to take photographs in Guam during his/her temporary sojourn, subject to the restrictions as noted on the reverse side of this permit.

R W C K
Deputy Commissioner of Customs & Immigration

Original - Licensee
Duplicate - Records & Accounts
Triplicate - Bu. Immigration File

Original

PACIFIC TO HONGKONG

This Martin flying boat is probably the most famous airplane of the day. Bearing the romantic name China Clipper, the ship is shown China-bound.

the integrity of an aviation company whose planes span the vast Pacific with clockwise precision.

Since I first visited these islands a decade ago, Hawaii has been the wonder spot of the world. All roads led to the Hawaiian Islands. Getting there was merely so much time wasted. After my flight across the Pacific on the *Clipper*, Hawaii became merely a part of a large experience. Never again will it be Utopia itself. Its hibiscus, its gardenias and its palms can never dim the memory of the other islands in the Pacific, the newer and smaller ones which play such a brave part in the advancement of transportation and civilization.

The *China Clipper* laid all of Hawaii bare. It spread before us the entire map of the Territory at one fell swoop. Even before Oahu and Honolulu faded out of sight there arose Maui, Kauai and Molokai, each of which claims a separate audience for people on the surface of the earth.

The fact that in flying across the Pacific to Hongkong we were 500 miles from the nearest land at times did not enter the thoughts of *Clipper* passengers. They merely looked at their watches upon leaving Honolulu and asked how many hours it would be until time to land at Midway 1,300 miles away. Just like on a steamer. You never think of the distance to the next continent and what you would do in case of emergency. You banish all fear and merely think in terms of the arrival hour. On a steamer it is a matter of days. On the *China Clipper* it is a matter of hours.

An interesting thing about ocean flying is that unless you can see the water, the land or the horizon, you cannot tell whether you are flying parallel with the earth, going sideways, up or down. Your personal opinion is worthless. In blind flying, as in heavy rains, fog or a squall, you can tell when the *Clipper* makes an abrupt change in altitude by the pressure on your eardrums.

If you cannot see out, due to fog, heavy rain or darkness, there is a reliable way to tell whether you are climbing or going down. When you sense a change in the altitude, yet the engines sound the same, you are probably going down. If you feel pressure on your eardrums but the engines suddenly roar, you know that the *Clipper* is climbing.

One time far over the Pacific, 6,000 miles from San Francisco, I thought we must have been climbing. The *Clipper* rocked ever so little. Perhaps it was nature's way of reminding modern travelers that we are not just sitting on a train or the deck of a ship when we fly an ocean, but that instead are actually high, high, high in the air.

I always felt that if I leaned over with my nose to the window I would tip the flying boat. In heavy cloud formations there is usually an accompanying roughness, but where you stand in the *Clipper* makes no difference. During the daytime going through large and dense

Even in American protectorates, the regulation of tourists or "transients" is strict. Passes and permits of many descriptions must be obtained on voyages like this. Miss Haven's Guam pass (below) was comparatively easy to get. Nations outside American jurisdiction are strict on cameras.

RESTRICTIONS

Par. 3 Chapter XXXII: Civil Regulations with Force and Effect of Law in Guam.

It is forbidden to take pictures or to have in one's possession cameras, films or plates, photostat, tracing or reproduction outfits, or instruments for topographical survey, mapping or sketching in the following districts:

Mt. Tenjo, Mt. Alutom, Mt. Chachao and their contiguous plateaus, Mt. Macajna, Cabras Island, Piti Navy Yard, Orote Point west of sign indicating restricted area, Tipalao restricted area as shown by signs, and the area comprising the hangar, adjacent storehouses, and workshops formerly occupied by the air force at Sumay.

THIS PERMIT TO BE SURRENDERED UPON DEPARTURE FROM GUAM.

NAVAL GOVERNMENT OF GUAM

TRANSIENT VISITOR'S PASS

No. 362

1/20/37
(Date of arrival)

(Date of departure)

Name: Violet Sweet Haven Inmate

Nationality: USA Age: 29 Sex:

Height: Weight: Complexion:

Color of hair: Eyes:

Destination: Manila

The above described person is hereby authorized to visit Guam for a period of not to exceed ____ days, subject to all existing laws, regulations and instructions of the Naval Government of Guam. This pass is revocable at any time at the pleasure of the Governor. See reverse side for special information.

ORIGINAL

P. M. Cate Jr.
Deputy Commissioner of Immigration and Customs

white clouds there seems to be a greater reflection of light making the sun appear to shine more vividly.

One time I asked a pilot how he could tell when to take the *Clipper* off the water. He said, "Oh just by looking at the speed and by how the ship feels."

The pilots become known for certain flying habits. One is known for his high flying. He goes high above the clouds and picks a course usually 10,000 feet or more, a half mile above the average cruising altitude. Another captain on the China run is known for his steep, direct landings.

Different pilots take different lengths of time to attain their altitude, varying from 20 to 45 minutes. *Clipper* passengers soon begin to know the flying habits of their captain on a trans-Pacific flight and accustom themselves to his quick takeoffs, high flying and other idiosyncracies.

Clipper ships can be flown across the Pacific without lights or altimeters. Pilots can even fly them blind and land at night, but in all cases the ships land and take the air under manual control. That is always a source of consolation to the passengers as they shoot across the Pacific.

The worst meteorological factor in ocean flying is "icing up," or flying at an altitude where the humidity and temperature cause ice to form on the wings. When this happens it is necessary to fly to a higher altitude where there is not enough humidity to form ice, or to a low altitude where it is too warm to form ice.

Headwinds are difficult for flight comfort and the trans-Pacific *Clippers* occasionally have to cope with typhoons along the China coast. A typhoon is an air condition which moves counter clockwise at the rate of 100 m p.h. in the center and often has a diameter of 100 miles. It varies in size according to intensity.

Along its outer edge the motion of a typhoon is perhaps 70 or 80 m.p.h. and it travels in a forward course at the rate of about 25 m.p.h. Typhoons are much like hurricanes and are charted from year to year, it being possible to forecast them days in advance. Because of the knowledge of their exact location they are not hazards in trans-Pacific flying.

As we came down for landfalls at Midway, Wake and Guam, the tiny island airbases along the *China Clipper* route, the passengers complained of being sleepy. Sleepiness at sea level is true even if you descend a mountain, but it is sure fire on coming down from flying at 10,000 feet all day long. This drowsiness on the Pacific flight was aided by the fatigue of flying in rarified air, but we were always sure of sleeping well after flying all day over the ocean.

People who travel from the United States to the Orient by steamer say they feel as if they own the boat and have always lived on it by the time they arrive in the Far East. It is no wonder, inasmuch as they have lived, slept and played aboard the steamer for nearly a

(*Continued on Page* 88)

Lightplane Engine Cowling and Bracing

THE photograph at the right shows the crankcase bracing devised by H. J. Johnson of Lemont, Ill., for his ship. He reports that the results "do the job." An even more novel "invention" is the cowling devised for the lightplane shown below. Charles Grieder of the Jersey Air Service, Oakland, N. J., writes of the trouble that company had in keeping their ship's engine from freezing up. "The reason we had so much trouble with pistons seizing," Grieder writes, "was due to the excessively high temperatures in the heads and cylinder barrels, causing the oil to gum immediately upon contact, then carbonizing and sticking the rings fast in the grooves. We had no precedence to go by in building this cowling, as we had no way of checking the air flow around the cylinders on the ground, so it was a matter of cut and try all the way through. After 60 hours, we finally found the cowl that gave the desired results. The temperatures are now satisfactory." The cowling weighs but three pounds additional.

Here is H. J. Johnson's bracing system.

Note the cleanness of the new cowling for lightplanes devised by a New Jersey owner.

Snakes and Planes Don't Mix!

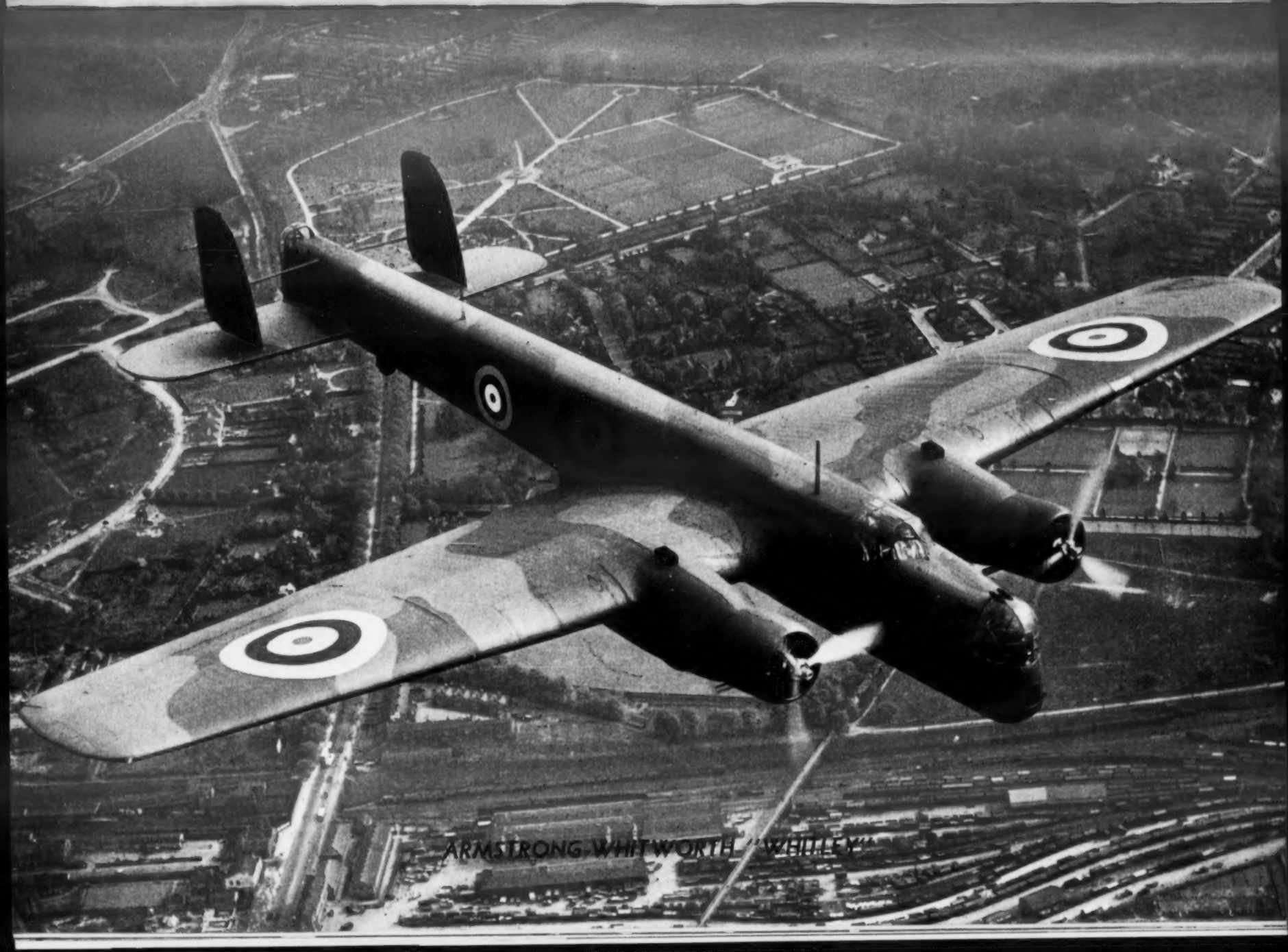
FUNNY things can happen to pilots. A flyer stationed in the Philippines not long ago was cruising out over the sea when suddenly a brightly colored object in the bottom of the cockpit attracted his attention. At first he could not make out just what it was. Then it slowly began to move and his blood curdled. A pit viper! One of the most deadly and vicious snakes in the tropics.

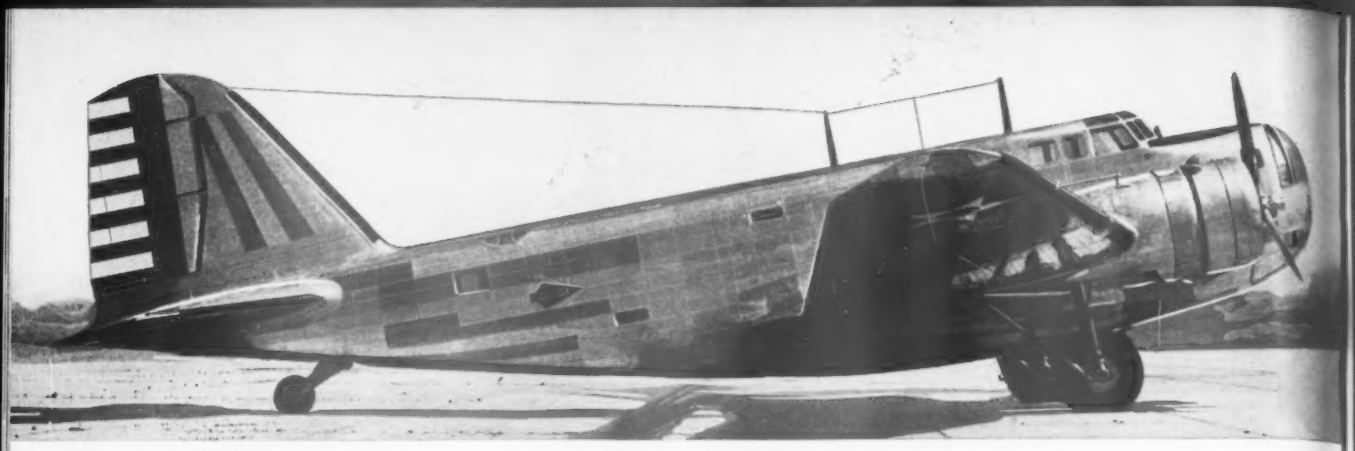
Before the pilot's bulging eyes the reptile slowly uncoiled itself and slithered back towards him. Below were the angry waves of the wind-lashed Pacific. Banking the plane around gently, he headed back toward the islands. He hoped the snake would not strike.

The viper slid back between his legs and reared up on half its length. At each swaying of the ship, it darted its head menacingly from side to side.

Suddenly an idea took form in the pilot's mind. The pit viper, he knew, inhabited low, jungle swampland and very likely could not stand the freezing temperatures and thin air of high altitude. If he could pull the plane up in a climb without the movement infuriating the

(*Concluded on Page* 89)


ARMSTRONG WHITWORTH "WHITLEY"



An Airliner Turns Bomber

Noted the world over as a commercial airliner, the Douglas transport now has taken on a newer deadly guise. More than a hundred B-18 Army bombers are now on order.

WITH the advent of larger, more luxurious airliners during the past year, the famous tried-and-true DC-2 design that boosted Donald Douglas to fame and success as an airplane builder neared obsolescence. But, when the Army Air Corps called for bids for a new bombardment aircraft, Douglas saw a potential market for his DC-2 factory equipment. Following the same general lines of his famed transport, Douglas built a "test" bomber and entered it in the Air Corps' 1936 bomber competition. Army pilots put the ship through the most rigid maneuvers and, after exhaustive flight tests of several competitive designs, accepted the Douglas and designated it B-18. Soon afterward, Douglas Aircraft was awarded an Army contract for a large number of the ships.

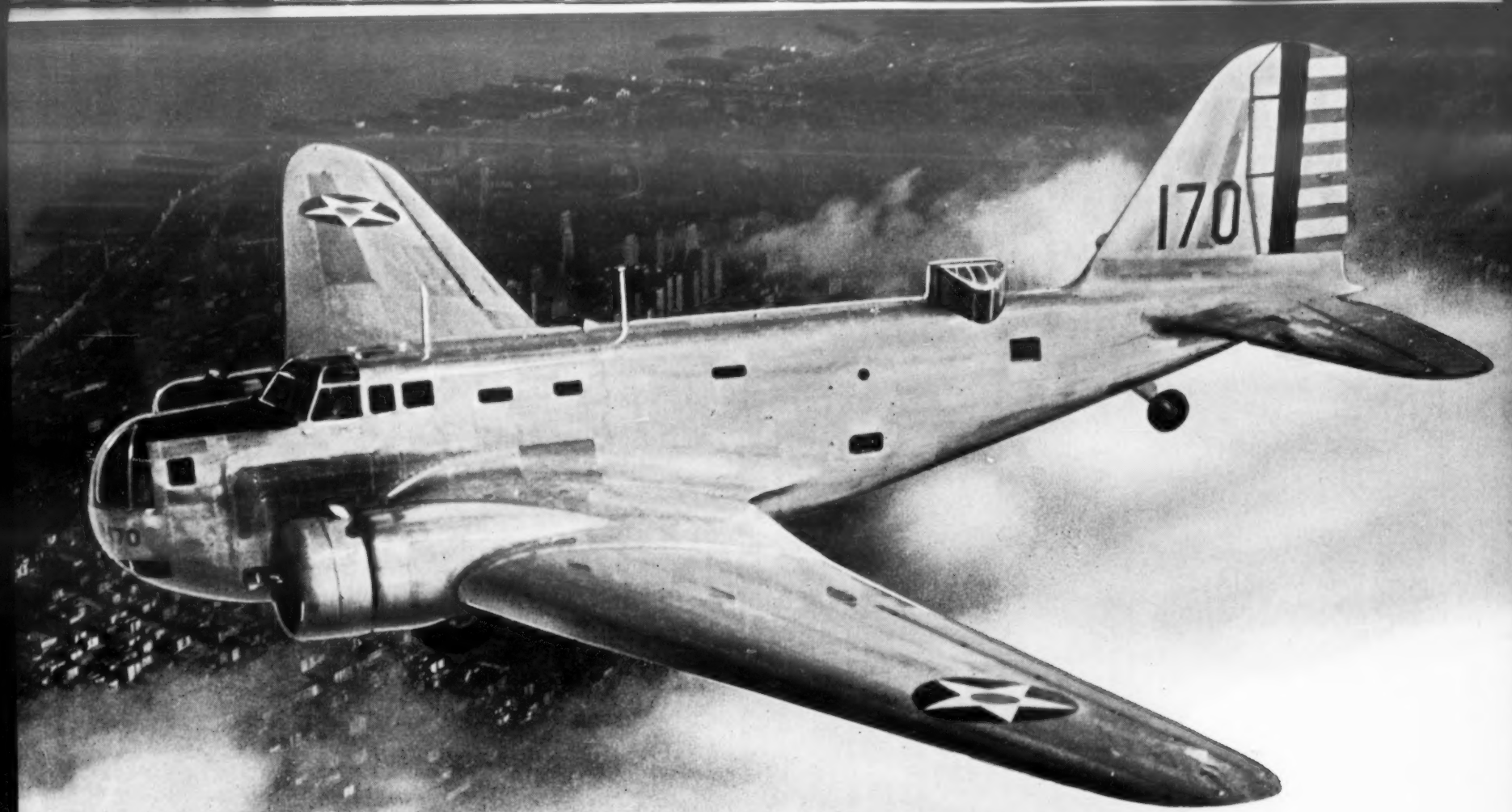
Though the ship at the top of this page bears Wright Field's insignia, many B-18's already have been delivered to the Air Corps. The photographs at the bottom of this page and on the opposite page are of ships that now are on active duty at Hamilton Field, California. As more and more of these ships are completed and delivered, they will replace present Air Corps bombardment equipment that is growing obsolete.

Powered with two Wright *Cyclone* engines, the B-18 is said by observers to have a top speed in excess of 225 m.p.h. That speed, combined with the known weight-carrying ability of the DC-2 transport, shows promise of making an ideal bomber in all respects. Carrying a heavy load of bombs, the B-18 should have a cruising range of approximately 1,000 miles. In addition, the B-18 is heavily armed with flexible machine guns, some mounted in retractable "nests" like that shown on the ship on the opposite page, and others in the floor and revolving nose turret. In any event, it would be almost impossible for enemy fighters to find a "blind spot" on one of the new bombers. And, as bombers always fly in large flights, for fighters to attack such a formation under any but the most favorable conditions would be near-suicide regardless of the odds.

Bombs in the B-18 are carried in a large space in the forward part of the fuselage. To release these bombs, two trap-doors open the ship's belly in the middle and the bombs drop off racks inside the fuselage. Bomb sights and levers are operated by the bombardiers whose observation and sighting windows can be seen in the lower front end of the fuselage.

The conversion of transport aircraft into bombers has long been a controversial subject among aeronautical experts. Such conversions have been tried in the past, most recently in the Spanish and Chinese wars. Coincidentally, both Spanish and Chinese forces have confiscated American Douglas airliners and converted them into bombers. Reports have shown these ships to have performed fairly well, all things considered. Structurally, however, the American ships have withstood even the hardest treatment. Hence, the new B-18, though now a true bomber, is nonetheless basically the DC-2 airliner.

The two ground views of the new B-18 at the top and bottom of this page show the sturdiness and size of Uncle Sam's latest "death angel". It carries a "formidable" bomb load, is heavily armed.



DOUGLAS B-18

Photograph by 88th Reconnaissance Squadron, U. S. Army Air Corps.

Our Front Cover: the Boeing B-17

The War Department recently let another contract for 13 more of these huge four-engined "Flying Fortresses". Thirteen already have been delivered to squadrons.

THE photograph on the front cover is a new venture on our part. In fact, it is a comparatively new venture in the printing field for our particular kind of production. The photograph original was an ordinary 35 mm. Kodachrome frame among several that were taken at the recent National Air Races at Cleveland by POPULAR AVIATION'S photographer, N. R. Strohmeyer. Photo fans will be interested in the fact that the striking picture on the front cover was "blown up" from the original picture which was made with a miniature camera. If readers of POPULAR AVIATION show enough enthusiasm for photographs like this, we will experiment further with them.

It is significant that the much-discussed Boeing B-17 "Flying Fortress" happens to be the ship with which we try out this novel front cover. The ship itself is as novel to military circles as our photograph is to our printers. Now that the Air Corps has a sizeable fleet of these aerial battleships, it has had to devise ways of using them to the utmost advantage. Just how well this has been done remains to be seen. The recently-rumored mass flight by these huge landplanes across the 2,440-mile stretch of ocean to Hawaii is an important one—even if it never goes through—at present. There is no question in the minds of Air Corpsmen that the flight is entirely feasible *with a full load*. The B-17 is supposed to have a cruising range, fully loaded, of a good 3,000 miles—probably more.

What can this mean militarily speaking? Imagine, then, a flight of say 50 of these bombers loaded to the tail skids with high explosives. Imagine that squadron setting forth from the United States to attack an approaching enemy. They could intercept the enemy some 1,200 miles off-shore, attack from practically any altitude and, by sheer weight of numbers, literally wipe a small fleet off the face of the earth. Enemy fighters—unless there were at least 100 of them together—would be foolish to attack the Boeings, for each one of those 50 bombers would be armed to the teeth with at least six machine-guns. And, with an American aircraft carrier anywhere in the vicinity to send up its squadrons of fighters, well . . . . .

Granted, this is all conjecture. But it's a long way from being far-fetched. Not only is such a long-range flight feasible, but the Air Corps has already proved it so. The ferrying flight of each B-17 from the Boeing factory at Seattle to its base, say at Langley Field, Virginia, would have been regarded as phenomonal just a few short years ago. These flights have been made non-stop clear across the United States with a normal load of fuel *and at average speeds in the vicinity of 230 m.p.h.* But aviation advances so quickly these days that Boeing already has test flown an even huger bomber—the B-15.

There has been talk recently of plans to send a flight of these ultra-modern bombers flying across the Pacific to Hawaii along the route flown by the China Clipper.

Letters

RARELY have we attempted to ballyhoo ourselves or seek out slaps-on-the-back. Now, however, we are extremely interested in what our readers—and the aviation world—think of us since we "went modern."

We seek, most of all, truthful comment and criticism. The three letters below are *not* the type of comment we seek exclusively. These letters are highly complimentary and we sincerely appreciate them. But regardless of what your thoughts are concerning us, we want to hear your side of it. We can take it.

Dear Sir:

("Lockheed: From Vega to Super-Electra" in the October issue of POPULAR AVIATION) is written just as I have wanted to see it done for two or three years. It's fine and the boys here are mighty pleased. In particular, Cyril Chappellet, secretary of the company, was very much tickled because he thinks it is one of the best breaks we've had in an aero mag for many moons.

Incidentally, may I congratulate you and the staff on putting out a fine magazine? You are doing a grand job and are a credit to the aeronautical industry. I know from actual experience that POPULAR AVIATION is causing a lot of people with no particular interest in flying to read about aviation—and it is all due, I believe, to the sane, colorful handling of material which is constantly being evinced in your publication.

Sincerely,
JAMES V. GRIFFIN,
Lockheed Aircraft Corp.
Burbank, Cal.

Dear Sir:

May we say that we think POPULAR AVIATION is a very well got-up journal and full of interesting matter. We particularly appreciate the page on Bristol *Blenheim* bombers, which we think looks very good (October issue).

Sincerely,
R. D. PEARCE,
Bristol Aeroplane Co., Ltd.,
Bristol, England.

Dear Sir:

Over the week-end I went through the current (October) issue of POPULAR AVIATION quite thoroughly. Though I only glanced through some, all of the articles read were very interesting and instructive. Of particular interest were your parachute jumping experiences, the Lockheed story and Swanee Taylor's comment.

I might conclude that POPULAR AVIATION, in addition to generally reporting on the state of the art, is out to get at the facts concerning little known or misinterpreted phases of aviation—and does it well.

Sincerely,
DEAN B. HAMMOND,
Stearman-Hammond Aircraft Corp.,
South San Francisco, Cal.

"....Clear and Unlimited"

by SWANEE TAYLOR

New York's recent American Legion convention moves POPULAR AVIATION'S commentator to the discussion of "behind-the-scenes." Swanee's thoughts are most interesting.

Legion Convention . . .

It will be difficult to determine just who—the nation, the Legion or New York—profited most from the 19th annual American Legion convention in New York City late in September. The whole picture was far too vast, too moving and too splotched with rich spiritual colors for anybody to pass judgment without long and lasting deliberation. One thing, however, stands out like a wedding cake in a monastery; the indisputable fact that Americanism burns as fiercely today as it did 20 years ago. Only, it is 20 years smarter and sager. For both of which we utter a devout, Praise be God!

That a nation profits tremendously from a demonstration that took 18 hours to hurry past a given point, should go without saying. For, what greater assurance of national security can people have than in the knowledge that a crackerjack standing army of more than half a million hell-for-leather type of men is ready to spring to arms against all enemies of the flag—*internal as well as alien!*

If you think for a minute that the American Legion, as it stands today, can't handle any situation that might arise you had better call on your local veterinarian and have your head looked into. Why, after one look at us Gen. Hugh S. Johnson, an illusionless old pitterrier, was moved to remark, "You could put these men into olive drab tomorrow and they still would be an army." Which, along with being high professional opinion, are the sweetest words an ex-soldier can ever hear.

Happy to say, there still is nothing fascistic or otherwise rabid in the Legion's make-up. A surprising fact that not only confounded the Nazi and Communist blocs, but struck actual terror in their humorless hearts. Yes, it did this country a lot of good to have the Legion here in the hot-bed for all brands of dictatorial plotting and scheming. Some of the anti-American ambitions have, here of late, been getting pretty gol-darn cocky. But lordy, how the convention turned their dampers down.

One instance of this came quite vividly to your devoted correspondent's personal attention. Air Services Post 501, along with many other Manhattan posts, assembled for the parade over in East 29th street, directly in front of a big communist bookship. During our six hour wait to march hundreds of the buddies milled in and out of the joint while the wretched little reds huddled in corners pop-eyed with fear. Yet nobody jumped on them; the tolerant spirit of democracy wasn't violated in the slightest degree. Which, I believe, gave the scared little monkeys more of an idea of their impossible road to travel in this country than anything else we might have done.

Swannee Taylor

Terribly significant, too, was that hushed remark I chanced to hear from the lips of a serious-eyed young woman communist. I honestly believe a fleeting light of comprehension shone in her face as she whispered, "Gee, they're kind of nice at that." More than likely all that is needed to turn this young person into a loyal cooperative citizen is for someone to point out the high practicability of working democracy over the brittle, icy ideology of communism. The American Legion will do well to ponder this point.

The Legion itself profited from the New York convention in that it learned, first-hand, something of the character of the people who inhabit the most thickly populated section of our country. Great will be the tales carried back to the remote corners of the nation by all. And in so doing the Legion will be knit in closer unity than ever before. Legionnaires who couldn't make the trip will get detailed eye-witness reports of how the Department of New York didn't get started until ten o'clock at night, but even so, marched to a man proudly behind massed colors until three o'clock in the morning in the name of blessed American Liberty.

Hundreds of thousands of our compatriots will hear tall stories about the seething mass of humanity who make up this town. But those men, women and children who had a chance to walk elbow-to-elbow with us will, I know full well, shout to the world that we are American to the core; that never will any sort of ism whatsoever be allowed to take root in our part of American soil.

Plain to see, such knowledge will serve as a potent tonic to the entire American Legion body. It always tones up your system you know, to know that your liver is all right.

And did dear dizzy little ole New York profit! Oh, I don't mean in a dollars-and-cents way, we could have struggled along without the five or so millions the boys dropped here. No, our benefits were deeper and far more lasting. For one thing, it meant that we had to step out of character and be human beings for four days, thoughtful and courteous. And how we loved it. Believe it or not, people in this town walked around with actual smiles on their faces for days and days.

I am ashamed to report that the two local aviation posts put up a very miserable showing in the parade, utterly unworthy of the Legion principles as well as traitorous to the loftier aims which aviation is supposed to stand. One thing is certain, we had better mend our ways by joining actively with all Legion doings, (inside politics excepted) else stand aside and let a younger, more devoted generation pick up the flag of citizenship.

Legionnaire Letter . . .

Detroit, Michigan
Sept. 15th, 1937.

"Dear Swanee:

"Just finished your October '. . . Clear & Unlimited' and sure got a kick out of Bob Jelliffe's letter walloping dear old Aviation Post 257, American Legion, of this city. I gather too that Bob is echoing the sentiment of both POPULAR AVIATION and yourself.

"When Aviation Post was organized, several years ago, the membership consisted entirely of war-time pilots, mechanics and veterans who had since become either pilots or mechanics. By an extremely broad interpretation of the membership rules a number of veterans have been allowed to join Aviation Post. These men, not charter members, are responsible for the anti-aviation resolution Bob Jelliffe is taking exception to.

"I received my first air time in the hind end of an old Bristol Fighter twenty-one years ago, but couldn't stand the idea of flying backwards. I soon wrangled myself into the front seat, and

since then I've done my flying facing forward; at least, most of the time.

"Yes, I'm a charter member of Aviation Post, and believe me or not, I'm ashamed of that membership. But there'll come a day! This durned un-American, anti-aviation resolution was slipped over during the summer when no one but the dodoes were able to attend the meetings. A lot of us didn't know about it until it had been presented to the Michigan State Convention of the American Legion. Boy, it looks like a hot winter for Aviation Post. Something very unpleasant is going to happen to those chaps who are willing to sacrifice anything for the sake of a little lousy publicity. Before spring Aviation Post will be singing a different song.

"POPULAR AVIATION is the only magazine in the field with guts enough to defend the amateur, and I can't see any loss of advertising space on account of that policy. Here to P.A., long may she wave."

The writer's name is purposely withheld in the hope that he can launch his worthy drive with a degree of cunning equal to the opposition. Needless to say I will support him to the last gasp. So will everyone else who believes in individual freedom in the pursuit of happiness aloft as well as on the ground. Which doubtless includes most of Aviation Post 257.

An Open Letter . . .

The National Air Races Corp.,
Cleveland, Ohio.
Gentlemen:

Now that the shouting has died away may I relay to you some thoughts that came to light during the last National Air Races. I feel amply qualified to report on the mutterings that were voiced by the Industry. Likewise, as one whose business it is to feel the public pulse, I feel perfectly capable to diagnose audience reaction.

In the first place, both the Industry and the public greatly enjoy, and endorse, your annual aviation world series. Beyond this, everyone likes Cleveland tremendously. You make up a rare community in this happy land, hence you doubtless are genial enough to listen to constructive criticism and lend your ears to our desires.

The National Air Races should be by far and large the greatest outdoor spectacle of them all. Of this I'm sure you will agree. In the same breath you will have to agree that the 1937 races missed achieving greatness by a wide margin. This was due to several factors. Principle among which were, an utter lack of program balance and the lamentable practice of running the races out of sight of the audience. Obviously, both of these glaring mistakes can be corrected.

To illustrate the point, let me say that it is extremely poor "theater" to open any show with an international champion's performance. Tex Rankin, who won the world stunting championship, should have been spotted much later along in the program. He should have

(*Concluded on Page 73*)

Remember the Jenny?

The famous Jenny was used for practically everything an airplane possibly could have been. This ship was converted to floats and served well in the Far North region.

A SHORT time ago, we announced that we would like to find some old-time photographs of Jennies, Standards and other early aircraft. Particularly, though we were after Jennies—and we got 'em. At present, space forbids us to use all the Jenny pictures we have received but, to those of you who answered our request, we beg you to bear with us until suitable disposition can be made of your contributions. . .

Our interest in these aeronautical old-timers was only prompted by that same urge that makes a reader of POPULAR AVIATION want to stop and look at pictures of these ships. The mere mention of the names "Jenny", "Standard", "Canuck" and a dozen others recalls fond old memories that, after all, are really not so far behind us. It wasn't so long ago that many of our present-day transport pilots were banging away at the controls of a barn-storming "crate." It wasn't so long ago that we thought nothing of snipping off a bit of an unknowing farmer's fence-wire to hold a wobbling strut in place. And golly, what a job it was flying sight-seeing hops from sunup to sundown in those old wing-wavers! Even though we could make a few hundred dollars in cash in one day. Those were the days we could get $10 a head for our air-minded groundlings.

Oh well, "them was the good ole days" all right. Every so often we see a dusty fuselage back in a hangar. It's a hard job walking away from it.

Tsk tsk! Such Carryings-on . . .

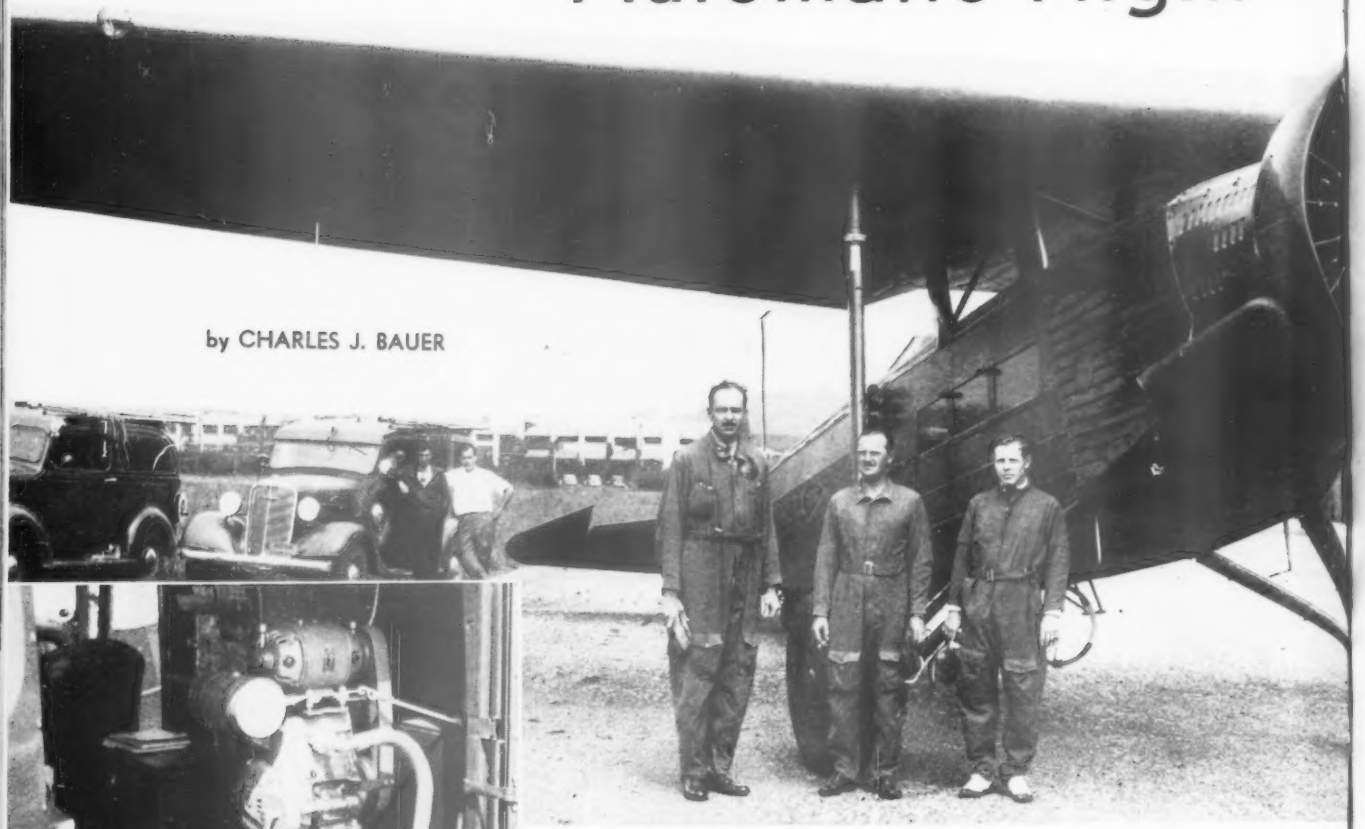
"See heah, young man! Mistah Ozzenblotz sees no one without an appointment . . ."

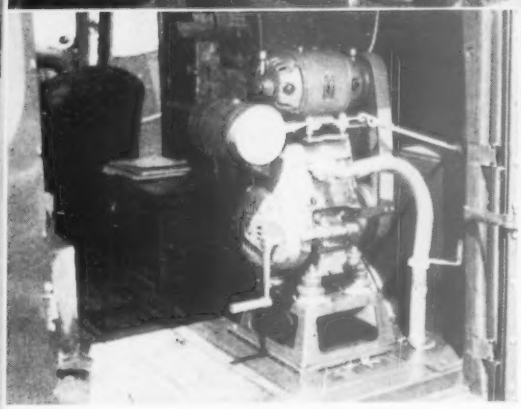
"Flight" photograph

GLOSTER "GLADIATORS" for Belgium

Automatic Flight—

by CHARLES J. BAUER





Unsung heroes of this Army development are Capt. Carl J. Crane, Capt. G. V. Holloman and Raymond Stout. Inset at left shows generator mounted in truck.

Will the airliner of tomorrow fly without a human pilot at the controls? If this latest Air Corps development means anything, automatic flying from take-off to landing, will be commonplace.

ON the level sands of Muroc Dry Lake, California, an airplane gathers speed for what looks like an ordinary take-off, rises in plenty of time to clear a truck in its path, and grows smaller and smaller to the eyes of the group of army officers and civilians on the ground.

Soon the plane reappears, and flies lower over the truck, to land on almost the precise spot from which it took off.

You expect the next moment to see the pilot alight from the plane, but no one gets out. Instead—

"Go over and shut her off, Joe," says one of the officers. "We'll let her take another spin after lunch."

The scene is only a little less remarkable than that presented on a sandy stretch of the Atlantic coast 34 years before, when the Wright brothers made the very first heavier-than-air powered flights. These California tests are another step in the perfection of entirely automatic flight—automatic from start to finish, including landing and take-off.

Already the Army has perfected the complete automatic landing, in which the controls are not touched by human hand or foot. This achievement, under direction of Capt. Carl J. Crane, has been brought about at Wright and Patterson Fields, Dayton, Ohio, by radio equipment.

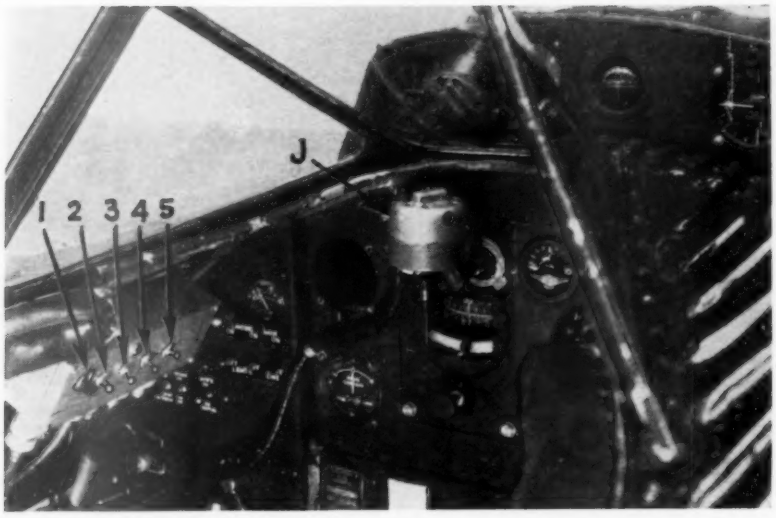
Now, at Muroc Dry Lake, the same method is being adapted to automatic take-offs and flight. The flight described above is a glimpse into the near future, in anticipation of the successful culmination of the tests. But it is a prediction entirely justified by the amazing success of the landing technique. Should one permit his imagination to enlarge on the possibilities suggested by this success, where might it not lead!

Planes under complete control with no one aboard become, for military purposes, emissaries of destruction. For commercial use, we may think of them as mail and express rockets, operable at speeds prohibitive to human comfort. Scientific missions, assigned by fiction writers to more spectacular "space ships," may be entrusted to robot radio craft like this.

Less sensational, but certainly revolutionary, is the belief that passengers soon will hurtle from coast to coast, nonstop, under automatic radio control. Army experts announce that elements in their automatic landing system, when applied to commercial airlines, will preclude the drifting of planes from their course, and eliminate the possibility of colliding with

The mobile ground station uses this type antenna.

An Air Corps Achievement



To land by using the Army's new system, a pilot need only throw switch No. 1. Preset wave-length switches are 2, 3, 4, 5. "J" is the automatic gyro-pilot attachment.

Contact with the ground throws the disconnecting switch ("I") above.

peaks and canyon walls over mountainous regions.

The development of the airplane since the World War has been accompanied by multiplication of instruments and controls to such an extent that pilots have expressed the need for simplification, repeatedly.

Most important concession to this demand has been the automatic pilot, or gyro-pilot, which is basic in the army's automatic landing system. The gyro-pilot essentially is a free-mounted gyroscope to which are connected sensitive controls of the ailerons, rudder and elevators. Any tendency of the plane away from level flight is corrected automatically. The gyro-pilot is standard equipment in military and commercial airplanes.

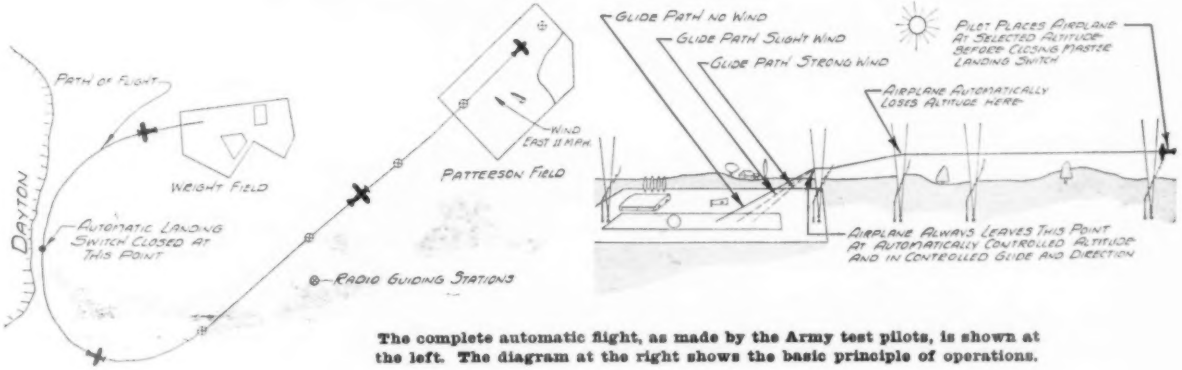
The second element in development of automatic landings is the army radio compass. This, in effect, is the conventional magnetic compass, but instead of pointing to the magnetic pole, the needle points to any radio station to which the pilot tunes. Thus, tuning to a station, the pilot may fly direct to that station simply by keeping the compass needle vertical, correcting a tendency of the needle to drop off to the right or left by altering the course slightly in the opposite direction.

The radio compass is vital to the army blind landing system, which differs from the automatic landing system in this, that in blind landings the pilot at all times retains complete control of the ship. Unable to see either ground or sky, the blind-landing pilot watches his altimeter, artificial horizon and other instruments to gauge his position in relation to the landing strip, and to time his landing glide.

For the first recognized solo blind landing ever made, in May, 1932, at Patterson Field, Capt. Albert F. Hegenberger received the Collier Award for the outstanding aeronautical achievement of the year.

Subsequent development of the technique he employed has led to perfection of the radio control used in the new automatic landing system. The two portable radio stations used in blind landings have been increased to four, and each of the four transmits at a different wave-length. The key to the automatic landing system is the ability of the radio equipment in the plane to tune in on each station in succession, as the plane passes over the preceding station.

About two years ago Captain Crane and his assistants announced that they had perfected a device coordinating the action of the radio compass and the gyro-pilot. This device, called the "directional relay," enables a pilot to fly direct to a radio station simply by tuning in on its wave-length. Corrections needed to keep the compass needle point-


PATH OF FLIGHT
WRIGHT FIELD
DAYTON
AUTOMATIC LANDING SWITCH CLOSED AT THIS POINT
WIND EAST 11 M.P.H.
PATTERSON FIELD
RADIO GUIDING STATIONS
GLIDE PATH NO WIND
GLIDE PATH SLIGHT WIND
GLIDE PATH STRONG WIND
PILOT PLACES AIRPLANE AT SELECTED ALTITUDE BEFORE CLOSING MASTER LANDING SWITCH
AIRPLANE AUTOMATICALLY LOSES ALTITUDE HERE
AIRPLANE ALWAYS LEAVES THIS POINT AT AUTOMATICALLY CONTROLLED ALTITUDE AND IN CONTROLLED GLIDE AND DIRECTION

The complete automatic flight, as made by the Army test pilots, is shown at the left. The diagram at the right shows the basic principle of operations.

ing vertically are imparted to the plane control surfaces by the gyro-pilot.

With this development, an army crew flew from one commercial radio station to another, with hands off the controls, and no more effort than is required to tune in on the various stations. The plane would fly to the station selected, and continue to circle over it until the tuning was changed.

From this point the perfection of automatic landings developed rapidly. Reasoning that by setting up a series of portable radio stations they could fix a flight path, experts tackled the problem of making the plane fly automatically to the stations, and in a certain order. Setting these stations in a straight line into a landing field, they gave each station a different wave-length.

The outer station was set at 365 kilocycles, and the others at 300, 219 and 201 kilocycles, respectively. The plane was tuned in on the first or outer station. As it passed over the station, a marker beacon on the ground, projecting a vertical pear-shaped field, flashed a red light on the instrument panel. Then the pilot tuned in on the second station, and as he passed over it a second marker beacon flashed its signal. The process was repeated over the third and fourth stations, and then the plane, which all along had been losing altitude, was placed in a landing glide. This was a modified blind landing.

The next step was to make the procedure entirely automatic. This was done in part by developing a "frequency selector," responsive to impulses from the marker beacon. The selector is capable of tuning in the radio compass to the four guiding stations in succession. The pilot is informed of the correctness of the automatic settings by observing an indicator, which he consults as he passes over each station.

Imagine yourself in the cockpit of the army automatic-landing plane, with instructions to make a robot landing. You reach over with your left hand and turn a switch. This switch tunes the compass instantly to 365 kilocycles, the station farthest from the field, and about eight miles from it.

The plane crosses this outer station and the marker beacon impulse is received and transmitted to the frequency selector, automatically changing the wave length to 301 kilocycles, the wave length of the second station. At this point the landing path of the plane is determined. The plane may pass over the first station in almost any direction, but swings in a close arc to head for the second station, crossing it in a true line for the third station.

All the time the plane is losing altitude automatically, thanks to coordination of the throttle and the altimeter. Landing in a headwind, the plane would tend to lose altitude faster. The altimeter controls the plane by advancing the throttle under such a condition, so that the plane passes over the inner and fourth station at between 250 and 275 ft.

(*Concluded on page 73*)

Those Bombers in China . . .

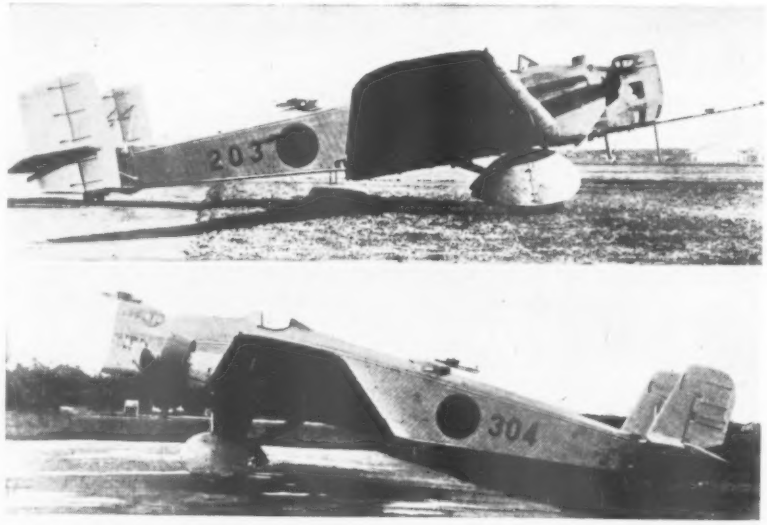
Though little has been heard about these American-built Chinese bombers, they nonetheless are feared by Japanese. China has been a fine Curtiss (Condor above) customer.

THE daily newspapers and the newsreels have brought the dangers of modern aerial warfare home with a bang since the opening of Japan's "undeclared war" on China. Unlike the general aeronautical situation in Spain, modern military air equipment is being used extensively in the Chinese-Japanese conflict.

What the Chinese dread more than anything else—so far as Japanese aircraft are concerned—are bombers. Not because Japanese bombers are so superior to anything owned by the Chinese, but because there are so many Japanese bombers as compared to a few Chinese defensive planes. Long a good customer of American aircraft manufacturers (Curtiss, largely), Chinese government representatives today are known to be in this country with large amounts of cash at their command. They are willing to pay almost anything for modern American aircraft to be used against the Japanese. The United States' rigid ban on the exporting of war materials, however, has made the obtaining of American aircraft virtually impossible.

Previous to this ban, though, China had purchased large numbers of American ships like the Curtiss *Condor* bomber shown above as well as modern Curtiss *Hawk* fighters, Boeing fighters and others. And, contrary to the "popular" beliefs about "Chinese aces" (One Wing Low, etc.), Chinese airmen have consistently been whipping the Japanese in the sky, according to reports.

Japan's present "aerial supremacy" in China is due largely, experts say, to quantity, not quality. Huge fleets of lumbering slow Japanese bombers have rained death on Chinese cities largely because opposition from the air has been slight. Chinese anti-aircraft guns, though, hit the big ships with ease.



Japan is wreaking havoc on helpless Chinese cities with Kawasaki and Mitsubishi bombers (above). Chinese anti-aircraft, though, find these slow ships easy prey.

A Preview of the Douglas DC-4

by DeWITT WENDELL

Here is an enlightening "inside story" on 1938's ultra-modern airliner that rapidly is nearing completion. Our draftsman's drawing below also is an exclusive feature.

OUT in the Douglas Aircraft Company's new air conditioned hangar, which is so large it dominates Clover Field at Santa Monica just as the zeppelin hangar looms over the Navy's station at Lakehurst, mechanics are assembling an airplane which represents about the finest craft that the best brains in big time aeronautical engineering can devise.

This machine is the giant Douglas DC-4, an all metal, low wing commercial monoplane with four engines and a tricycle landing gear much like those fitted to the newest safety craft among smaller airplanes. If ever an airplane was built as a result of community effort this one is such a ship. Its entire history is one of joint effort by many men.

It was conceived to meet a set of specifications drawn up by the country's big five airlines: American Airlines, Eastern Air Lines, Pan American Airways System, Transcontinental & Western Air and United Air Lines. It was fathered by 50 different designers, it was engineered by two dozen men who were enlisted for the job as a team, and its interior was arranged by another dozen flight engineers representing the airlines and the Douglas company.

If the machine lives up to its carefully calculated, conservatively estimated performance charts, it will be one of the greatest machines ever built. And if it does meet its specifications it probably will be seen within the next 18 months in regular airline service on the country's busiest airports.

Indeed, if the machine is as successful as other Douglas models, notably the DC-2 and DC-3, it will be flown over the airways for a number of years to come. For this ship is intended to be an efficient instrument for the airline operators for at least five years after it is placed in service. This is a long time in the life of the commercial airline industry.

But long life will be an essential for airplanes of the DC-4 type. The first plane is costing $600,000 to build, what with the engineering, research, tooling, and other expenses. Each individual DC-4 built thereafter will be sold for about $250,000 to the airline operators who joined in purchasing the first one. To other buyers the price may be even higher.

When business men spend sums of money as large as these on flying equipment they expect it to be usable, swift and efficient so that it will be profitable over a long period. This is essential if they are to realize a return of their money with a profit.

The airline operators, of course, are in business for a profit—if it is possible to realize one. They say that if ships of the DC-4 type are purchased they must be flown for five years to depreciate them fully. So the DC-4 probably will be around quite a while once it arrives.

Now to return to the ship itself. The accompanying drawings show the exterior lines, the landing gear arrangement, and alternate suggestions for interiors of the passenger cabine. They do not, however, serve to impart a true idea of the enormous size of the craft.

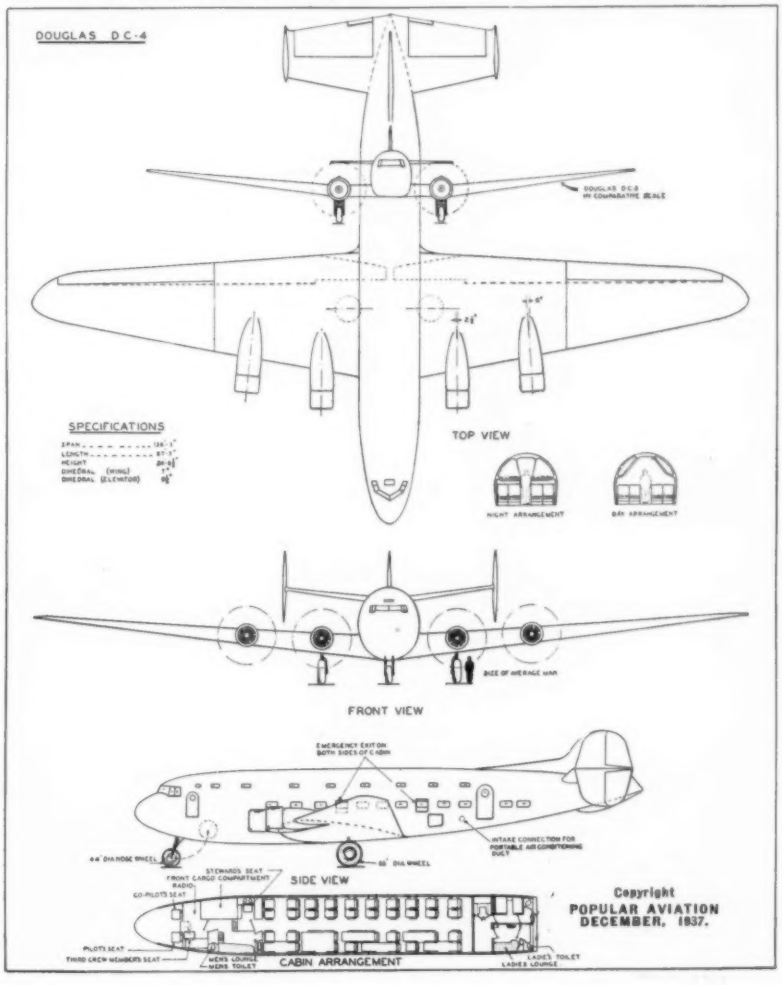
It will be, when completed, the largest landplane ever built in the United States. It will be larger than the Martin ocean flying boats (Pan American's trans-Pacific clipper ships) and about twice the size of the Sikorsky clippers. The fuselage of the DC-4 will be longer than the wing spread of the largest landplanes flown today, which have a span of 95 feet.

This new ship will be so large that, once assembled for flying, it never will be placed in a hangar until the wings are dismantled for overhaul purposes. It will be parked in the open while it is in active service.

The reasons for this are its dimensions. The span is 138 ft. 3 in.; fuselage length is 97 ft. 7 in.; overall height is 24 ft. 6 in. The main landing wheels will be 65 in. or 5 ft. 4 in. in diameter and the nose wheel will be 3 ft. 8 in. in diameter.

When the ship is stopped in normal position on the ground the entrance to the cabin will be 9 ft. 6 in. off the ground. Passengers will climb a special portable stairway when they board the plane. The ship will rest on the ground in flying position, not cocked at a crazy angle as in the largest ships that are supported today on a tail wheel.

With a plane so large, you can imagine the problems that arose in connection with the controls. It was suggested that the



physical strength of the pilots would not be sufficient to move the enormous aileron, flipper and rudder controls with the machine in flight and moving at 200 m.p.h.

Experiments, however, showed that by balancing these controls with great care and providing linkages which gave the pilots great leverage, it will not be difficult to provide light responsive rudder pedals, wheel, and stick. On the ground these surfaces will be locked to prevent the wind from slamming them around.

The army's sad accident with the first Boeing "flying fortress" bomber which was taken off the ground with all controls locked and immediately thereafter stalled and crashed causing the deaths of three men and injury to three others, caused the Douglas engineers to work out a new locking system.

Even if the Douglas is taken off with locked controls the pilots will be able to override the locks and move the surfaces, thus forestalling an accident similar to the army's.

The tail surfaces of this new Douglas are unique as one glance at the diagrams will show. This triple tail is fitted with triple rudders. Those on the outside move both above and below the flipper, but the rudder in the middle moves only above the horizontal flipper surface. Below the flipper the center rudder becomes an added fin area.

This type of tail provides unusual stability, insures excellent control down to stalling speeds—an essential quality in such a large machine with a wide range between cruising and landing speeds—and, the engineers believe, will eliminate the "hunting" tendency which was found in both the DC-2 and DC-3.

Furthermore this tail will allow the DC-4 to have an unusually wide center of gravity range. Thus it will be possible to fly the ship easily and safely in many attitudes, with flaps up and down, and with widely differing load conditions. Last of all the triple tail and fin area eliminates the need for building one enormous fin which would tower 35 ft. into the air. With a tail of this height it would be impossible to get the ship into a hangar for overhaul without removing the tail also. This was a consideration in the decision to turn to the triple tail.

Not without a number of experiments did the engineers decide to use a nose wheel instead of a tail wheel. This innovation was found to have many advantages over the older type of gear. All its characteristics, however, were tried out in actual flight by equipping a Douglas *Dolphin* amphibian with a nose wheel.

Army, Navy, airline and Air Commerce Bureau pilots flew the *Dolphin* thus equipped in all sorts of winds and made cross-wind, down-wind, fast and slow landings with it. It was discovered that the tricycle gear is so stable that the worst landings become good when it is used. Tendencies to ground loop are eliminated because the main landing wheels are placed behind the center of gravity so that the main mass of the machine always leads these wheels. In more conventional airplanes the main mass of the ship follows the main landing wheels.

Ground loops are caused by forces generated when the wheels of conventional airplanes are slowed down before speed of the machine drops to a safe level. In such circumstances the mass of the ship attempts to get around the landing wheels thus causing the swinging now known as ground looping. With the tricycle gear, however, the mass of the machine swings the nose wheel and leads the main rear wheels. The plane can never be off balance and consequently little or no damage can be done even when it is flown into the ground when "crabbing" badly in a cross-wind.

One of the finest features of the tricycle gear is that it lends itself perfectly to landing down a curved radio beam as all the country's airline pilots expect to be doing by the winter of 1938. Such instrument landings will be simple in the DC-4 for it can touch down at a safe flying speed and then be brought to an abrupt stop by slamming on the brakes without danger of nosing over.

All the landing wheels will retract into the fuselage or wings of the DC-4 once the big ship is in the air. The wells into which these wheels will be pulled will be covered over by fairing strips which will leave the surfaces perfectly streamlined.

Engines for the new ship will be the latest Pratt & Whitney *Twin Row Hornets* —14 cylinder two row radial engines of 2,180 cu. in. displacement. They develop 1,400 h.p. each for one minute at take off at 2,500 r.p.m. using 95 octane fuel, and 1,200 h.p. using 87 octane fuel and slightly less r.p.m. Normal rating is 1,150 h.p. at 2,350 r.p.m. with 95 octane fuel.

Two engines are faired into the leading edges of the wings on each side of the fuselage. They are almost buried in the deep section of the wing, although following practice today the mounts jut well ahead of the entering edge of the wings so that the propellers turn in entirely undisturbed air. Constant speed automatic controllable pitch airscrews are standard.

For the first time in a commercial machine, the engines on the DC-4 will be relieved of the load of pumping the giro instruments in the cockpit, generating electricity for the cabins and the pressure for flaps and the landing gear retracting system. Instead they will be required only to pump their own fuel and turn their own magnetos.

All the other loads which have been measured at more than 250 h.p. for a large machine, will be borne by special four cylinder engines which will be mounted behind the inboard engines and in the same engine nacelles. These motors will generate 110 volts for the lighting system and the radio will heat the ship and the galley stoves, and provide power for the navigating instruments, the flaps, etc.

The inside of the DC-4 is unusually roomy—and this applies also to the cockpit where three men always will be on duty The men who do the flying sit close to the instrument board with every flying and navigating instrument duplicated down to the brake pedals which both pilot and co-pilot will operate. The third seat in the cockpit will be used by a captain who will merely be the air vessel's commander but will not touch the controls, or for a radio-operator navigator, or even for a special flight mechanic.

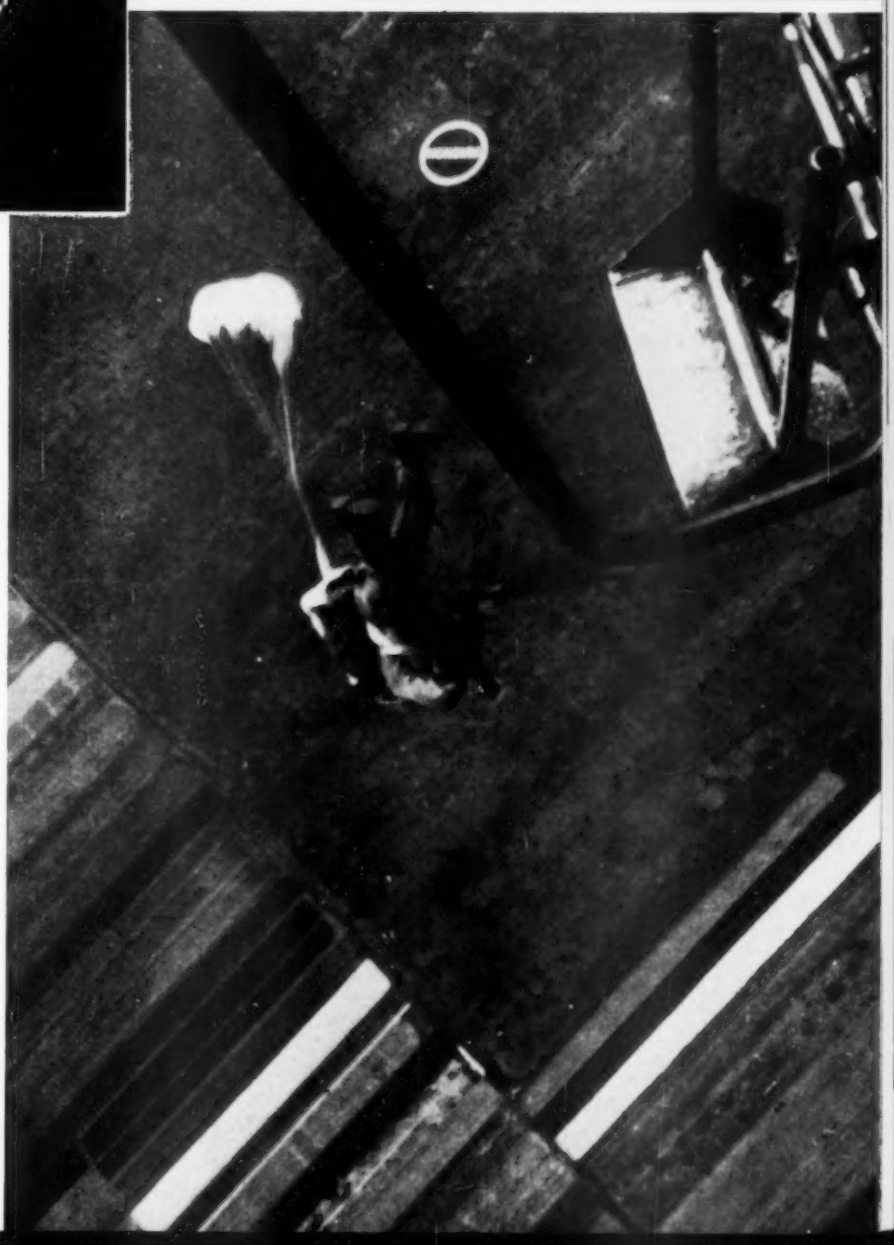
Arrangement of all the instruments (flight, engine, navigation), radio, controls of all types, etc., was decided upon by a committee of pilots who later will be called upon to fly the big ships. They placed the seats, decided upon the type of windshield to be used, and grouped the switches, throttles, controls brakes and dials as they chose.

(*Concluded on page* 93)

. . . . . and Then, Perhaps He Will

"Golly, I've always envied those aviator fellas. I wisht I could fly some day."

Bail Out!



FROM time to time we have told you stories about parachutes, shown you innumerable pictures of parachutes and even attempted to describe for you the feelings of a jumper as he tumbles headlong down the sky. But this, we believe, is the first time we have been able to show something of what a parachute jump is like. If you think it's so death-defying and hair-raising, stop reading for a second and consider the attitude of young Kim Scribner, the Maryland University sophomore shown thumbing his nose at the cameraman just after bailing out at 8,000 feet. This enterprising young man now is working his way through college by stepping out into space for $25 per step. In accordance with government regulations, Scribner is wearing two 'chutes, in this case a back pack and lap pack.

A little less cocky, perhaps, but nonetheless the same are the two thrilling pictures at the right. Both were taken in France during a recent exhibition. The big transport used is especially equipped with handrails and step for jumpers. The upper view is back toward the ship's tail. The second jumper, whose head is seen peering out the door in the upper picture, is headed for the airport (marked by the white circle in top center) head first in the lower scene. Notice the position of the jumpers' right hands in all three pictures. They all had their hands on the rip cord as they stepped out. The jumper in the lower photograph can be seen yanking the rip cord loose, releasing his pilot 'chute which popped out immediately. Because a jumper is out of and far below the ship in one second, the photographer had to start tripping his shutter while the jumper was on the step in order to get the bottom picture.

New Fighters for the Army

P-35 and P-36

The monoplane has definitely come into its own as a sturdy military design. These latest ships are now in production.

Curtiss has a juicy order for more than 200 of these fast P-36 fighters.

A PROBLEM of the Army Air Corps just a few years ago was equipment for its personnel to fly. Today the tables are reversed. The Army is having a hard time getting pilots. Equipment, meanwhile, is comparatively plentiful—and there is more coming.

So far as pursuit aircraft are concerned, the "more" that is coming now is being supplied largely by Seversky and Curtiss. The Seversky P-35 shown on this and the opposite page already is being delivered to GHQ Air Force bases. The Curtiss P-36 shown on this page and the back cover only recently passed acceptance tests at Wright Field. An original order for 210 of these ships was announced shortly afterward by the War Department.

By far the largest single fighting plane order yet placed by the American government, the latest Curtiss contract is interesting. The 210 ships, with "an adequate complement of spare parts," will cost $4,113,550. This single order covers two years' Air Corps requirements which, in turn, is expected to materially reduce the unit cost of the pursuit airplane in the future.

Almost basically identical with the P-35, the Curtiss fighter has many new features that are expected to substantially increase the efficiency of the pursuit airplane. Powered with an 1,100 h.p. *Twin Row Wasp* engine, the P-36 (and the P-35) is capable of a speed "in excess of 300 m.p.h." Both ships are also equipped with retractable landing gear and tail wheel and flaps now are standard pursuit-plane additions.

The most minute details were exhaustively worked out on these ships before the orders were placed. Everything possible has been done to make the ships easily serviceable and repairable in the field. For instance, special attention has been given to avoid multiplicity of sizes and gauges of tubing, bolts and rivets. Air Corps engineers have seen to it that the fuselage and wings are so standardized that, when damaged, they can easily be replaced.

In the case of the P-36, even a forced landing in water has been allowed for. A flotation gear has been built into the ship which can be inflated.

Even wheels-up landings have been anticipated. In fact, Air Corps officials now are practically encouraging it with the P-36 in many cases where a conventional landing might seriously damage the ship or pilot.

Seversky's fighter follows the same general lines of the Curtiss ship, though the P-35 was built and contracted for some time before the acceptance of the Curtiss design. Identical copies of the P-35 were flown by at least two pilots in recent National Air Race competition. One, flown by Frank Fuller of California, won the transcontinental speed derby.

END

Latest in landing gears is shown above and below. Retracted, the Curtiss gear (above) is cleaner than Seversky's (below). Note the similarity in the two ships' designs.

SEVERSKY P-35

This Bellanca is a Navy radio laboratory.

Just How Tough Are

The most rigid test any airplane can withstand is that of our military services. This story should make the manufacturers proud.

AT the aerial proving grounds maintained by our Army and Navy air forces, ships have to demonstrate to learned engineers that they can take it. When a plane successfully runs this gauntlet of tests, the most exacting in the world, there can be no better indication of its soundness. It is generally agreed that the U. S. Army and Navy demand and get more from their ships than any other service in the world. Specially designed military aircraft have been consigned to the scrap heap through their inability to master the difficult flight tests. Uncle Sam has even purchased military planes from foreign governments for experimental testing, but not one of these ships has successfully passed the rigid requirements which every plane accepted into our Services must pass. In fact a popular British fighting plane, used in large quantities by the Royal Air Force, disintegrated while undergoing the punishing terminal velocity dive and took the life of Lieut. George Cuddihy of the Navy Flight Test Section. Since that tragic event Uncle Sam has refused to purchase foreign military planes.

And yet our stock commercial planes have been passing these tests almost daily. In every military aircraft gathering such as the recent war games in Southern California you will see familiar commercial models all decked out in red, white, and blue standing wing to wing with powerful fighting craft. No better proof of the stamina, power and unsurpassed strength of our commercial planes could be offered than to see them wearing the colors of the Services.

One of the outstanding ships of the present day, the Lockheed *Electra*, has been accepted by the Army, the Navy and the Coast Guard and large numbers of these planes are being flown daily by these branches of our air force. Known as the Y1C-36, the Air Corps version of the *Electra* is used for high speed transportation for officers, supplies and enlisted men. It can transport 12 officers and 600 pounds of baggage or supplies from one air depot to another at a speed of more than 200 m.p.h. Ten are now in use and are stationed at vantage points about the nation's air bases. In the Navy the *Electra* is known as the R20-1 and its uses are transportation of officers, men and equipment. Three are in use and they have cut the commuting time from Atlantic to Pacific Coast Naval air stations in half. The Coast Guard model, R30-1, is used for radio experimentation as well as high speed transportation. Only one is now in use by this Service branch and is stationed at

You would think that an airplane intended to hook onto a big dirigible in flight would have to be "special". Not so, though, for the above Waco sport ship merely got a new paint job and "sky hook" from the Navy. The Douglas DC-2 (below) is used extensively "as is" for Army, Navy and Marine transport.

The Stinson also is popular in the Navy.

Our Commercial Ships?

by ROBERT McLARREN

the Cape May Coast Guard station when not roaring about between various other Coast Guard stations.

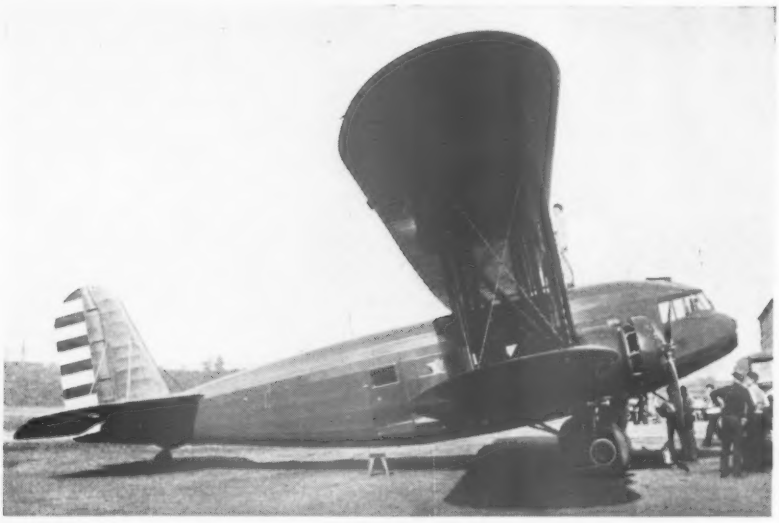
Other Lockheed models have been found fit for use by the Army and Navy. Among these is the famous, record-breaking *Altair*. This low-wing monoplane was known as the Y1C-23 in the Army Air Corps and as the XRO-1 in Naval aviation. High speed transportation was their main work. The familiar *Vega* high-wing model was also used by the Air Corps. Known as the C-12 it was later revamped into a speed plane and as the Y1C-17 Capt. Ira C. Eaker flew it to many records. These models have all passed out of service.

The Douglas DC-2 has become the most popular large transport in the world. It is used in large numbers throughout the major countries and it would be practically impossible to circumnavigate the globe by air without covering at least half of it on this ship. The Army, Navy and Marines have proven no exception in the selection of this plane for their heavy duty transport needs. The Air Corps uses three models: the C-32, C-33 and C-34 for their work. The first model, of which only one was designed, is the flying office of the G. H. Q. air force. The C-33 is the stock 14 passenger model of which eight are in service. The C-34 is the heavy duty cargo type of which 16 are now in use. Capable of lifting four tons of equipment from the ground these giant ships have proven of invaluable aid in cross-country high-speed transportation of weighty and bulky supplies. The Navy uses their R2D-1 for personnel transportation as does the Marine Corps. The former flies two, and the latter one of these giant and luxurious Douglas airliners.

The popular Stinson *Reliant* has also proven its ability to "take it" in the Navy and the Coast Guard. Used in both branches of the service as experimental radio research ships, it has been responsible for several valuable improvements in radio receiving and sending technique. The Navy XR3Q-1 and the Coast Guard QR-1 are both equipped with the Lycoming 245 horsepower radial engine.

Another well-known private cabin ship, the Waco, has recently been ordered in a lot of three by the Coast Guard. Known as the J2W-1, the planes will be used for high command transportation and communication missions. Only very minor changes were made from the stock model. An earlier model, the popular Waco F-2 sport biplane, was purchased by the Navy. A trio of these three-seater open-cockpit ships were assigned to the

The autogiro is much more than a "gadget" airplane. The Navy has been giving its 'giros serious tests as possible observation ships. The above ship is a Pitcairn. Oldtime airmen believe the Lockheed "Electra" (below) is probably the "sweetest flying" transport of the day. The Services have several of them.



Airlines used the Curtiss "Condor" (above), Byrd took one to the South Pole with him—and the Army, Navy and Marines use them for transporting cargo.

Here is one airplane that everyone used—and the airplane that no one will ever forget. Henry Ford's famed old "tin goose" was a flying masterpiece.

Though the Douglas "Dolphin" (below) was originally for the commercial market, it is used today almost exclusively by our military aviation forces.

U. S. S. Macon for communication tactics. On their upper wing a regulation "skyhook" was installed and they carried out their duties with all the snap and dependability of specially designed military planes. One of these ships was lost in the fatal crash of the giant dirigible. The other two are now used for high-command transportation.

Going back a few years we see that the famous Fokker monoplanes have been used with outstanding success by the U. S. Army Air Corps. The widely used tri-motor was purchased in quantity and, as the C-7, it established an enviable reputation for sturdiness and dependability. As a matter of fact this ship was the first plane to complete the Pacific crossing from Oakland to Hawaii. The story of the flight of the *Bird of Paradise* with Lieuts. Lester Maitland and Alfred Hegenberger at the controls is known to all. Another record added to the laurels of this famous old ship was the flight of the tri-motored *Question Mark* breaking all existing refueling endurance records. The parasol monoplane seven-passenger commercial model was also contracted for by the Air Corps. It was designated C-14 and some are still in service doing heavy duty transport service. Another version, the C-15, was fitted out as an ambulance plane and is still in use, having entered the Service in 1931.

The famous Ford tri-motor seems to have been used at about every job man could invent. The Army used large numbers of them and as the C-4 they completed many a task worthy of recognition. The Navy also depended on these "tin ducks" and as the RR-3 they have left a long and enviable record of service. The Marines used another version, the RR-5 for mass-personnel transportation to and from maneuvers. None remain in service today.

The familiar Curtiss *Condor* was another grand old ship that found favor in the eyes of the Army, Navy, and the Marine Corps. Heavy duty cargo and personnel transportation was their mission and the C-30 (Army) and R4C-1 (Navy and Marine Corps) are still being used by the Services. Their ability to get three tons off the field has meant much to Uncle Sam.

The widely-used Sikorsky S-43 amphibian is now going into service with the Army and the Navy. Flexibility of operation seems to be the by-word of these ships and it is practically impossible to visualize what new uses Uncle Sam's aviators will find for them. Its ability to operate on either land or water would make it of invaluable aid for use in our mid-Pacific possessions which may be the bases for which they are intended. Other Sikorsky models have been used in the Services in the past. The Air Corps' C-6 was the commercial S-40 twin-engined amphibian design and the Y1C-28 was the single-engined model. The Navy used the RS-1, a twin-engined S-40 design, for over-water transportation of personnel. None are in service today.

Bellanca ships have been contracted for in the past by the Army, the Navy

and the Marine Corps. The Army used the giant and grotesque appearing *Airbus* for heavy duty transportation. The Navy and Marine Corps ordered the popular *Pacemaker* model for radio and technical flight research. These planes are still in use by all three Services.

The American *Pilgrim* was used by the Air Corps, eight of them flying under the designation Y1C-24. Personnel transfer was their duty.

The Consolidated *Fleetster* with its modifications was purchased by both the Army and Navy. The former, a stock model, was known as the Y1C-22 and was used for high speed transportation. In the Navy it was designated XBY-1 which means that it fell under the Experimental Bomber category. It was especially modified for this work but other Naval bombers proved more efficient and only the one model was constructed.

The Fairchild commercial monoplane was used by the Air Corps. Designated C-8 and C-8A they were used on photographic missions in which their high wing made them especially adaptable. They are still in use.

The Northrop *Alpha* and *Gamma* transports are now in use by the Air Corps and the Coast Guard. The former uses the C-21 (*Alpha*) for high speed transportation and the latter use the RT-1 (*Gamma*) in a similar capacity. This model, incidentally, is one of the most luxurious and refined planes ever placed in use by any branch of the Services. Much of the interior details of commercial models are omitted on the Service delivery models but no expense has been spared on the RT-1. It is a ship of which the Coast Guard can justly be proud.

Little known is the fact that both the Army and the Navy have purchased autogiros and are developing them for possible Service use. It is understood that both branches have realized little if any possibilities from these ships. Their slow speed and range-destroying whirling vanes obviate their use as fighting craft. Some hope still remains that their use as scouting craft may make itself apparent in the future. The Navy uses the Pitcairn and the Army has been experimenting with the new wingless Kellett.

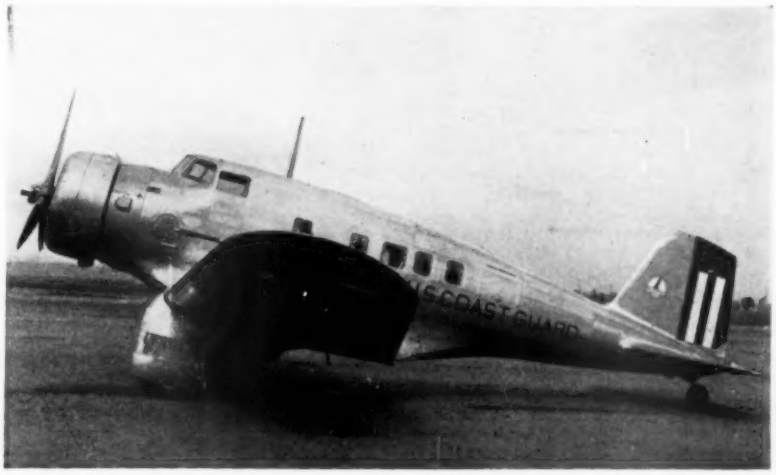
The new Fairchild "45" has been purchased by the U. S. Navy and the high command has expressed great satisfaction with the ship.

The Douglas *Dolphin* was originally introduced as a six-place commercial amphibian. Oddly enough, however, it has found a much larger sale in the Services than on the commercial market. The Navy uses the RD-1, RD-2, RD-3 and the RD-4, all modifications of the original *Dolphin* design. The Coast Guard uses the RD-4 in quantity for its rescue work. This particular plane has carved itself a permanent niche in aviation's hall of fame with its many errands of mercy successfully completed. Oddly enough, the Air Corps also uses large numbers of these planes for over-water operations. The *Dolphin* has been widely accepted by Uncle Sam and has played a real part in the advance of our Air Services. END

Lockheed played an important part in supplying our military forces with sturdy aircraft even back in the old days. The above ship is an early "Vega".

A later Lockheed "high command" ship was the above "Altair". This model too was originally intended for a high-speed commercial transport airplane.

Probably the most luxurious ship today in America's military air forces is the Northrop "Gamma" transport below. The Coast Guard and Army use Northrops.



Wanna Ride in the Target Boat?

Chicago's gangsters probably would like a toy like this steel-coated speedboat.

ANYONE looking for a thrill should take a ride in this new target boat built for target practice in the Royal Air Force.

It is a new high-speed type of boat, bomb-proofed against a possible hit by missles aimed at it by planes overhead. Protection is afforded by an armor plated deck and it can be controlled by radio when the practice is too hazardous for a crew. Shown here, it is speeding over Southampton Water on a trial run.

Questions

(*See Page 97*)

PERHAPS you are one of those readers who is proud of the fact that he or she reads each issue of POPULAR AVIATION from cover to cover. Well, we'll see now. Listed below are 10 questions chosen at random throughout this issue. Of course, you may not be as observing as you think. That's why we've given you the answers back on page 97. Anyhow, here goes:

1. When was the first solo blind landing made?
2. What does 26-S mean?
3. What manufacturer builds the B-18 bomber?
4. Generally speaking, what is the ideal type of airplane to own?
5. For what is Red Lake noted in Canada?
6. Has an airliner ever been catapulted?
7. What will the first DC-4 cost?
8. What new Army fighters are now being built?
9. What popular sport plane has been used as a Navy plane?
10. What is diplopia?

Giddap, Pilot!

TWO Army Air Corps men are getting the horse laugh — literally — from Army Cavalry men these days. All because the two Air Corps men (the Air Corps looks down on Cavalry both literally and figuratively and, naturally, vice versa) had to resort to horses during a recent flight from California back to their base at Langley Field, Virginia.

Lieut. Glenn C. Thompson was flying the ship. A Langley Field sergeant was riding along as passenger. Near Mitchell Station, Alabama, bad weather overtook the homeward-bound Army plane and Lieutenant Thompson "sat her down" in a pasture. But apparently no one in that section of Alabama pays any attention to airplanes for Lieutenant Thompson and Sergeant Baker finally decided they would have to head for the nearest town. Here's where the Cavalry comes in.

The two flyers spotted a pair of likely looking horses in a nearby field. They helped themselves and, helmet, goggles and all, rode five miles to the nearest telegraph station where they sent out their SOS. According to the Army Air Corps bulletin, "this trip (via horseback) was prolonged due to a rough motor and excessive head temperature in Sergeant Baker's fiery steed. The Sergeant asserts that henceforth he will have nothing to do with foul plugs (tsk! tsk!). Lieutenant Thompson gives it as his fixed opinion that helmets, goggles and flying boots are even more necessary on horseback than when in the air."

The moral to this little tale—if there is a moral—is that anyone who chooses flying should stick to it. Saddles and cockpits (ask the Sarge) just don't mix.

And Now—the Frieze Weatherman Indicator

THE Frieze Airport Weatherman is a weather indicator designed specially for airport service and in particular for the dispatchers of airlines.

By means of the panel before him, the dispatcher can tell at a glance, the wind velocity, the wind direction, barometric pressure and outdoor air temperature. The whole story of weather is before him and accessible at any time.

The wind direction indicator shows readings through the entire 360-degrees of wind movement while the wind velocity dial shows all velocities accurately from zero up to 80 m.p.h. The wind velocity outdoor equipment consists of a three-cup anemometer that drives a self-synchronous generator electrically connected to a synchronous motor on the panel.

The barometer is a temperature compensated type reading from 28 to 31 inches of mercury, but if desired, a Pioneer altimeter can be substituted for the barometer where readings in feet elevation are preferable to pressure in terms of inches of mercury. Very frequently, ground level pressure by an altimeter is more important than simple pressure readings.

A good reliable panel like this has been needed at airports through which airlines operate for some time. At present, each airline has its own particular devices with which to ascertain this information. But the standardized, perfected panel like this latest device should eliminate all "trial and error" operations. Now, by the mere pressing of a button, the ground man can give the airline—or private—pilot exact information on the weather conditions locally without delay. The vibrator in the lower right hand corner of the picture below, incidentally, is a buzzing device that jars the sensitive altimeter just enough to keep it from sticking or "lagging" in its readings. This particular innovation has been in use for several years.

The simple, easy to read "Weatherman" has its four instruments ruggedly mounted.

"They Said I Couldn't Fly"

by MAX KARANT

If you wear glasses and get along fairly well on the ground, you're almost sure to kill yourself in the air—unless licensed. Yet, most dead pilots were licensed.

WHAT chance does the man-on-the-street-who-wants-to-fly stand of ever achieving that seemingly supernatural status generally bestowed on the airplane pilot? I was somewhat in the dark recently—but I know now.

Comparatively little.

Compared, for instance, to the many thousands of persons the aviation industry itself predicts will be flying within the next ten years. Why is it so difficult for the average safe and sane fellow who wants to fly to do so? Cost? Yes, to a great extent. Why is that cost so high? It boomerangs back to the fact that so few people want to pay the price. And one reason—one good reason—that prices are so high today is because, under the present governmental restrictions, so comparatively few people *can qualify for any grade of pilot's license.* Largely, though, it appears that much of private flying's backwardness today belongs in the lap of the government body that has been wielding almost autocratic powers over American civil aviation for several years—the Bureau of Air Commerce.

"Hmmm. You have a prism. Hmmm. And diplopia. Hmm. Something might happen. Hmm."

There are 17,132 licensed pilots in the United States today. POPULAR AVIATION'S readers alone total more than 50,000; *more than three times* all the airline, transport, limited commercial, private and amateur pilots in this country put together. Of these readers, roughly 86 per cent do not have any of these licenses. But practically every one of this magazine's readers is emphatic in his or her desire to fly. . . .

There was a time (one year ago in July, to be exact) when I fought what was practically a single-handed battle in defense of the Bureau of Air Commerce's one and only decisive step toward the betterment of the status of private flying in this country. That was when the Bureau launched its now-dead development program in an effort to help the private or amateur airman get a safer airplane for his use.

POPULAR AVIATION readers probably remember the heated controversy in this magazine over the aviation industry's condemnation of the Bureau's development program and the one airplane that today has reached a finished stage as a result of that program—the Stearman-Hammond. That was the airplane that, because of its almost unbelievable safety features, brought the aviation industry down on my head when I flew the first model of the present ship and described my experiences in POPULAR AVIATION soon after. Strangely enough, it is that same airplane that today has brought up this problem. A problem that, if the private pilot and private flying is ever to come into its own right, must be dealt with intelligently—and now. . . .

Just a few days ago I had another (it wasn't the first) close-to-home example of how intelligent some minds in the Bureau of Air Commerce can be. I had an article in mind. The latest model of the Stearman-Hammond had arrived in Chicago and it developed that I could have gotten quite an interesting story entitled something like "I Soloed in One Hour!" Inasmuch as it's more or less rare for a person to solo an airplane in less than three hours (six hours is more like it), the possibility that I could solo the Stearman-Hammond within one hour gave promise of something well worth writing about.

So I went to the Bureau of Air Commerce. It so happens that that bureau, by law, has absolute dictatorial powers over every square foot of air in the United States so far as aviation is concerned. Hence, one of the regulations the Bureau has set up under this law is that no person can solo an airplane without (up until either November or December when new regulations go into effect) a student pilot's permit. So, in order to protect Tommy Fowler, pilot of the Stearman-Hammond, I had to get a student permit in order to get my story. I have never held a pilot's license nor have I ever soloed an airplane.

In the office of the "official Bureau of Air Commerce medical examiner" I was seated amid a bewildering maze of glittering lights, measuring instruments, meters, dials and cutaway charts of various sections of the human body. Seeing I wore glasses, the first thing the doctor pounced on was my eyes. He took my glasses, waved them around a bit, then shook his head.

"You have a prism in your left lens," he told me gravely.

I must not have appeared very impressed by this statement, for he produced a black book that contained page after page of what the Bureau of Air Commerce thinks an airman should be like. Locating the eye section, the doctor read off some statements that gave the general impression that a prism is dangerous. And that wasn't all. There was something else called diplopia. That conclusion was arrived at after a nerve-wracking series of eye-gadgets, bright lights, contorted lenses and charts with letters on them took their toll on my eyes. Once again, quite gravely, the Bureau examiner pounded another nail in my aeronautical coffin:

"Diplopia."

Completely dumbfounded by this "death sentence" so far as my much-touted "privilege as a free American citizen" was concerned, I wrote Fred D. Fagg, Jr., current Air Commerce Director, and, though I don't know exactly why I should, attempted to beg his judicial forgiveness for something I'd never dreamed existed until I faced those eye-gadgets in the doctor's office. While waiting for his final word on whether he was going to let me enter into this super-fantastic realm set up and controlled by the Bureau, I went back to the doctor's office and passed the rest of my physical examination without difficulty. Then came a telegram from Washington:

"REGRET INABILITY TO AUTHORIZE PROPOSED FLIGHT INSTRUCTION AND SOLO IN VIEW OF DISQUALIFYING PHYSICAL DEFECTS REPORTED BY EXAMINER STOP APPRECIATE CIRCUMSTANCES AND WOULD LIKE TO COOPERATE WITH YOU BUT IN VIEW OF CHARACTER OF

PRECEDENT WHICH WOULD BE ESTABLISHED CONSIDER SUCH ACTION IMPROPER.
BUREAU AIR COMMERCE FAGG"

Which, minus the meaningless niceties, means just plain: "I don't think you should fly—so you don't fly." Despite the fact that I emphasized the fact that the only airplane I was interested in flying was that which the *Bureau of Air Commerce itself sponsored as the airplane any man could fly with safety!* And the airplane which I myself had flown in Washington a little over a year ago at the invitation of that Bureau!

From this point on the matter became intimately personal. When driving an automobile—or flying—I am my own (and other people's) worst critic. I had a long talk with the Chicago doctor again. In effect, he told me that my "condition" was such that I would not be able to judge distances well. That I would not be able to see another airplane approaching from my left unless I turned my head and looked in that direction; That if, by some possibility I happened to shut my right eye for any reason, I wouldn't be able to land an airplane while keeping that eye shut. That if "something terrible" happened in the air I'd be unable to fly safely using my left eye alone. Personally, I can't imagine anyone flying an airplane by holding one eye shut.

In other words, the Bureau of Air Commerce, assuming more authority than even a big-city politician, committed my theoretical crime for me, arrested me, tried and convicted me without my having a single *practical* chance to prove myself innocent. And during all this testing, not once did my examiners take me within 30 miles of the most conclusive proving ground I can think of—an airport. They just *took it for granted* I would do everything in the air in an effort to kill not only myself but everyone else in the vicinity.

This is not just a case of me as a writer for POPULAR AVIATION now. There always is another story to take the place of one I can't get. But me as an air-minded American citizen is something else again. I had flown before (never solo, of course) but only now, after some eight years, was I to find that, according to the Bureau's books and gauges, I am, by their final judgment, totally incapable of flying an airplane (including the Stearman-Hammond and its recent counterparts) with any degree of safety. I have a prism and diplopia. What either of them mean so far as my enjoying myself in flying the Stearman-Hammond is concerned, is beyond me. The dictionary, though, says a prism is "a transparent body bounded in part by two plane forces which are not parallel." Whatever that means. And diplopia, according to the dictionary, means "double vision of a single object." That's something I know a little more about. I know that double vision is dangerous. But I also know—because I've lived

(*Concluded on Page 92*)

Side-Lights on the Valve Situation

IN THE paper entitled "Power Plant Trends" presented at the April meeting of the Royal Aeronautical Society in London, George Meade, vice president and chief engineer of the United Aircraft Corporation outlined the present and future of aircraft motors. This paper was again presented by the permission of the Royal Aeronautical Society at the summer meeting of the Society of Aeronautical Engineers.

Outlined in the paper were the indication of future trends and what may be expected from the orthodox type of four-stroke internal combustion engine. The advancement pointed out that horsepower had been increased 100 percent in regard to displacement and crank speeds 50 percent, the M.E.P. had been increased from 132 lbs. to nearly 200 lbs. for temporary operation. Overhaul periods had been increased from 300 hours to 600 hours.

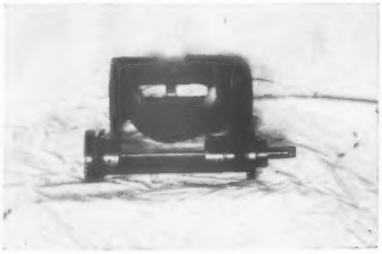
The article points out that fuels would have to be developed above the 100 octane rating, radical changes would be required in the size and number of cylinders, higher operating speeds would be expected, refined combustion chamber design, higher compression ratios and single sleeve valves.

One of the main facts divulged was that operating speeds are limited by valve-gear and by crank pin loading. Poppet valves have reached the end in regards to further development, therefore the solution lies primarily in a multi-cylindered motor with an entirely different valve action.

The main difficulty encountered in use of the poppet valve has been the inefficient ports required for intake and exhaust. Tests have proven that when the air speeds of greater than 150 feet per second are encountered, considerable loss is experienced by eddies and skin friction created.

In the average motor this speed is encountered at about 1,000 r.p.m. As the poppet valve is spring closed the efficiency has shown a decided drop on speeds above 1,000 r.p.m. This is caused by the elasticity of the valve face and valve seat.

Pictures have shown the poppet valve to rebound causing considerable loss of power. Tests have proven this cannot be overcome merely by increasing spring tension; although spring tension increases valve speed (at high speeds) it



Sub-assembled valve unit.

Here is the valve action dissembled.

simply increases the rebound as well as the driving force on the head of the valve, which in turn leads to valve failure by breaking.

Tests have shown that approximately 20 percent of the generated h.p. is required to operate the poppet valves and springs. Also encountered by the use of the poppet valve in the larger motors has been the inability to be properly cooled and manufactured.

Recent high speed pictures of poppet valves operating on a motor which was turning 3,500 r.p.m. indicated that neither the intake or the exhaust valves completely close at this speed, but simply ride the peaks of the cams. This could not be attributed to the lack of spring tension as stiffer springs did not materially alter the results. It was proven that at certain speeds the valve springs lost up to 60 percent of their power, this loss resulted by a moment of inertia caused by the spring vibration directly opposing the movement of the valve.

A valve has recently been developed by a group of western engineers which appears to be the solution of the problem. Tests in which a motor of 271 cubic inches, 4½ to 1 compression ratio, using 72 octane gasoline, was run close to 700 hours, during which test 60 horsepower was developed at 1,200 r.p.m.

The motor was operated up to 4,000 revolutions at which point 160 horsepower was developed. The fuel consumption during the test indicated the astounding average of .35 pounds per horsepower.

Five years have been spent in developing and building three motors in which the valve mechanism was completely proven. The final tests were conducted at one of the leading western universities and proved conclusively the performance. The valves on the past models have been a separate oscillating valve located in the top of the combustion chamber, for each exhaust and intake. The latest tests have indicated that a single valve could be made to operate both intake and exhaust. At present a motor of this type is under construction.

(*Concluded on Page 97*)

MILES "HAWK TRAINER"

"Flight" photograph

JAMES BASSETT, JR. *Interviews . . .*

Donald Douglas and Hall Hibbard on—

There is nothing fantastic about this article. The men who make this story possible are not day-dreamers. They are the men who have built today's "impossible" airplanes.

Donald W. Douglas

JULES VERNE could never have written this story.

What follows is no idle prophecy. Nobody smoked a hashish pipe, dreamed, then foretold the future. Rockets don't fly to the moon on these pages; airplanes don't speed 1,000 miles an hour; and battleships don't suddenly sprout wings.

What *does* follow comprises the reasoned predictions of three of the United States' largest aircraft companies. Brilliant engineers who today draft plans for tomorrow's aircraft have offered a peek into a highly logical future.

Saddle your time machine—

First we motor to a land airport where the midday New York ship is due at Chicago. (This would be the "local", for the "express" departs from Manhattan and stops only on the West Coast.) A mighty throng of passengers hastens up a long ramp leading to the doorway of a strange-appearing plane. No tail, no fuselage, no protruding engine nacelles, no long nose.

It is a flying wing!

Now for the seashore. Into a quay large enough to dock one of Uncle Sam's destroyers, tugs have warped a monster flying boat. Travelers — hundreds of them—are embarking. Outwardly it resembles a greatly streamlined *China Clipper*. But inwardly it is a de luxe edition of an ocean liner.

Who foresees these wonders? Donald Douglas, president of the great airplane corporation which bears his name; Hall Hibbard, young chief engineer for the Lockheed Aircraft Corporation; Schuyler Kleinhans, Douglas' chief flying boat designer; and engineers of the Boeing company at Seattle.

Evolution of the flying wing for landplanes looms as inevitable as the development of the Wright brothers' historic Kitty Hawk craft from the boxkite. For this you have the unqualified word of Hibbard and Douglas.

Growth of the present seaplane into something approaching a winged, tubular steamship is the forecast of Kleinhans and the Boeing company.

Behind these prognostications lies no hocus-pocus. Hibbard and Douglas have projected landplane trends over the next decade. What have they found? Let the former speak:

"Midwing ships are the next immediate step, combining the least drag with the most stability. Then we'll consider the dismissal of *every unnecessary appurtenance* from the airplane. Struts, guy wires, bracings, aerodynamic obstructions—all have disappeared. It's easy to guess what vanishes next. The tail and fuselage! This leaves only the wing. We must work on that."

Here is Douglas—the genius who produced the DC-2 and revolutionized transport travel:

"I prophecy the 'flying wing' when the need for the really large land transport arrives. We will demand one large enough to house our passengers, engines and express. We will call for a V-shaped wing capable of carrying more than 100 persons."

Describing tomorrow's flying boat, a Boeing spokesman said: "Increase of size of such planes is limited for the most part only by the power output of engines available. Boeing's construction of an 82,000-pound, 72 passenger 'clipper ship' is a remarkable example of the trend toward growing bulk in the flying boat classification."

Kleinhans—designer of the seaplane which so met Russia's unqualified approval that she ordered a half-dozen—minced no words:

"Give me $20,000,000, a trained staff of men, and two years' time, and I'll build you a 3,000,000-pound flying boat to carry 600 people! This I have plotted on geometrical laws of similarity, tracing the ratio of size and economy on a curved graph until the maximum efficiency was reached."

Fifteen hundred tons! More than 375 feet from nose to tailfin! Five hundred and fifty feet from port to starboard wing lights!

These engineers, hardheaded men selling products to airplanes who carry pay-passengers, haven't forgotten the ill-

Hall L. Hibbard

fated Soviet *Maxim Gorky* which catapulted 100 peasants to death in 1933. That was a cumbersome, spectacular experiment. Nor have they forgotten the brave old Dornier DO-X, which once hauled 169 newspapermen around the Swiss Lake Geneva—then took two painful years to bumble from Amsterdam to New York (via Brazil) and home again in 1930-32. Sporadic, overweening attempts, both, and unhappily years ahead of their time.

Briefly, consider three ships on the ways at the Boeing and Douglas factories today. Destined for the thin air leagues above the earth's surface, the former's Model 307 will be a four-engined, supercharged craft seating 33 persons and a four-man crew. Low-winged, the transport resembles a 1937-type ship built cylindrically and "cleaned."

Boeing already displays sketches of its super-clipper—the Model 314 flying boat—carrying 72 passengers and an eight-man crew in its streamlined 41 tons.

Douglas has half-completed the world's largest landplane. Forty travelers will occupy its giant, tapered fuselage.

Thinking of these, the men who designed them tell you that the "flying wing" must come. It is, they will insist, already on the way. Let young Hall Hibbard continue the story:

"The 'flying wing' probably will utilize a maximum of six engines, allowing normal flight on any four. Tomorrow's power plants haven't been built, of course, although present motors surpass 1,400 h.p. Gasoline engines will undoubtedly remain in vogue.

"Stainless steel, spotwelded for ultra

Planes to Come

Huge long-range ocean-going airliners like our artist's conception shown here are far from being impossible. All Engineer Kleinhans needs, he says, is the money and men to build it today.

'cleanness', will be the material for these wings. Although steel weighs three times as much as duralumin, it offers compensating strength. On our wing, it would feasible. Welding would also permit water-tight and air-tight construction."

Here Douglas differs. He lays his faith in duralumin, declaring that it can be thickened into a resilient, light "skin" at will. But he agrees that gasoline engines will power the transport of the next decade. Diesel progress, says Douglas, has been too slow.

Design of the "flying wing" shows a distinct V-shaped pinion. Only by a definite sweepback from the nominal nose of the craft, Hibbard and Douglas explained, could you obtain maneuverability. Fins at the wingtips and ailerons provide the control surfaces. Probably the ship would measure a cool 300 ft. from tip-to-tip. Passengers would stroll the length of several complete decks. Sightseeing windows in ceilings and floors and curved panes in the leading edge of the wing would allow all-side vision.

This "flying wing" will have the tricycle landing gear visible on the forthcoming Douglas DC-4 airliner.

Engines and cabins will be supercharged for smooth, unimpeded flight six miles into the blue heavens. This, Douglas observed, when "certain fundamental difficulties in the way of substratosphere flying" are conquered. For one thing, propellers must be pitched to afford "biting" surfaces for the rarefied atmosphere at 35,000 ft.

Speed?

Douglas believes that 250 m.p.h., allowing 12-hour service from coast to coast, marks the limit of economy. Hibbard urges that even 500 m.p.h. isn't improbable. (But then, the latter's new Lockheed "14" has just set a 260 m.p.h. record for commercial transports!)

On the sea, the problem presents different aspects. Kleinhans and the Boeing engineers prophesy that present flying boat trends will endure even in the future. They foresee disappearance of external braces for the huge wings, however, and complete streamlining of hulls.

From next year's Boeing 72-seater to Kleinhans' 600-man sky "whale" is a jump of a decade or two. Douglas' marine engineer agrees that the need for such behemothic creations must arise naturally, that air transportation must approach railroad-travel stature before a Queen-Mary-of-the-skies is practical. But he insists that *it can be done!*

Just for fun, he explains, he scribbled scores of pages of closely-written figures, all scientifically exact. They show:

Four 300-ton engines (probably Diesel, Kleinhans thinks) completely housed in the wing;

One 165-ton wing, a 150-ton hull, and superstructure bringing the total empty weight of the craft to 750 tons;

Crew, baggage, fuel and payload totalling another 750 tons.

Kleinhans declared: "It is all so utterly simple. The problem becomes clearer as the ship grows larger. We can reckon exactly what to expect as the present-day flying boat swells to such proportions. We know that speed will increase gradually—until this giant will cruise 300 m.p.h. at 12,000 ft."

How does Kleinhans know this? It is his business. He builds *big* flying boats today.

His flying Big Bertha was evolved on the present-day principle of 16.5 lbs. of ship per h.p. of engine. But on this basis,

(*Concluded on page 72*)

This Gas Model Ban

by KURT CASS

Much controversy has been raised lately against the flying of gas models. Herewith some comments on this situation.

The popularity of gas models has grown throughout the world by great strides. The above ship is entered in a French meet and is shown being "tuned up" by its builder.

DOWN in Massachusetts they have succeeded in sinking the lightplane builders and they are now, believe it or not, starting in to regulate gas driven models out of business! With the gas models once under control, we can expect a big drive on kiddie-cars, scooters and baby carriages. Big stuff—this.

Starting the ball rolling, to the edification of other state aviation authorities and establishing a precedent for them, Registrar Frank A. Goodwin and William E. Heaton, an inspector, both of Massachusetts, stopped the attempted test flights of five gas-powered models at Bowles Airport. Goodwin ruled that such models come under the head of aircraft and therefore cannot be flown in the State of Massachusetts unless they are licensed and operated by licensed pilots.

The engines of the models were being warmed up, ready for the flight, when the owners were stopped by Heaton. As the wing span of all the models was under eight feet so that it was impossible to ride in them, it is difficult to see why a pilot's license is necessary or even desirable.

Further, we fail ot see how a licensed pilot could have any more control over the models when they were once in flight than an unlicensed pilot, but such is the condition in the broadminded State of Massachusetts. We can understand now why they once burned witches at the stake in Salem.

As might be imagined, the owners waxed exceeding wroth and declared that they would move over into the more liberal State of Connecticut for their next tryouts, just as lightplane owners in the State of Washington moved across the state line into the open-minded State of Oregon some years past. Amateurs in any line have a tough time of it just as any pioneers, but this last step is an outrage to the cause of liberty.

If this stunt were pulled off in Illinois instead of Massachusetts, we would be inclined to believe that such a ruling was not unconnected with the idea of further license fees, assessments, fines and taxes, all for the emolument of the boys at the hall, but in saintly Massachusetts, this is unthinkable.

And what sweet gravy this would prove to be—five dollars sales tax, two dollars for licensing the model, two bucks more for a special pilot license, three bucks more for a contingency fee—that's the way it would work out in the prairie states where income is the principle motive back of the license stunt.

There have been rumors to the effect that some of the eastern states were about to pull off repressive measures relating to gas-powered planes, but this step is so quick and unusual that it sets one to wondering whether we still have our old rights as citizens or whether the Constitution has gone into the discard.

We have yet to hear of any serious accident due to the flight of a gas model which is quite remarkable when we consider the great number of these little machines that are flying at the present time, therefore we fail to understand why it is necessary to "safeguard" the public against possible damage by models. More persons die in bathtubs every year than in airplanes or railroad trains, but so far no repressive measures have been aimed at bathtubs.

We attach a letter of protest sent to Major Clarence D. Hodge, State Aviation Inspector of Massachusetts by Albert L. Lewis, secretary of the Boston Gas Model Society, which is quite interesting to gas model fans. It tells the whole story.

* * *

Major Clarence D. Hodge
State Aviation Inspector
Registry of Motor Vehicles
100 Nashua Street
Boston, Mass.

Dear Major Hodge:

As an active leader in the field of aeronautics and as a judge at many important New England model airplane meets, you recognize, undoubtedly, the value of building and flying model aircraft.

Perhaps no avocation is so closely allied with its bigger brother. Certainly more model plane builders enter the aviation industry than any other field. Admitting the importance of model aviation, we must study it rather closely to determine what its most important features are—the features most important to the aviation industry.

As you may know, Mr. Hodge, there are now two distinct types of model planes. These two classes are for non-flying solid models which frequently are used in wind-tunnel experimentations for the large aircraft companies, and flying models which are entered in competitions by their builders.

There are two groups of flying models—those powered by rubber bands, and those powered by compressed air motors and miniature gasoline engines. Of the latter group, gas models have supplanted the compressed air powered type.

The analogy between a rubber powered model airplane and its prototype is, of course, not very close. In most instances, rubber powered models carry their motivating rubber the entire length of the fuselage thus changing the balance as found in a large airplane.

Bill Stout, he of the Scarab and Sky-Car, hit the nail on the head at last year's banquet of the National Model Airplane Contest held in Detroit when he said that gas models provided the perfect field for experimentation with model aircraft. A field which approached large size plane design and performance.

With gas modelers spending approximately $40 and several months on each gas job which they turn out, it is remarkable how closely their work parallels the construction and design of large size aircraft.

Once they have constructed their gas model, gas builders are anxious to try out their craft in competition with other models. It is for this purpose that organizations such as the Boston Gas Model Society were formed. Contest flying carried out under the supervision of competent adults has never resulted in any reported injury to persons or property according to a symposium on gas flying which was held at this year's National meet.

At this symposium were representatives of the Bureau of Air Commerce from Washington, D. C., who were sent to Detroit to observe the 1937 National Model Airplane Meet and to compare

(*Concluded on Page* 82)

Personalities

ABOVE, from top to bottom, various personalities along the airways of the world are shown at their various occupations. The top photograph shows Ralph Kirbery, famed radio singer, showing equally famed announcer Graham McNamee (center) and actress Joan Marsh "what's what" in Kirbery's Cub. That terrified expression in the next and left picture is what a first-fighter looks like (name unknown) at his first spell at the controls. Miss Gretchen Reighard (right-hand picture) is Akron, Ohio's outstanding woman 'chute jumper. The first Taylor Cub in India is shown in the photo second from the bottom. Aircraftsmen from a British carrier assembled the ship, shown getting its first Indian warmup. Recognize famed Al Williams in the next photo?

BELOW is 21-year-old Arthur Dean Swift, "Official Hitch-Hiker" for the states of Connecticut and Maine. He has "thumbed" a total of 100,600 miles. Another "young-un" in aviation is Edward Somers, 12, shown in the second picture with his sister and elder brother, both pilots. The son of a New York congressman (also a pilot), Edward recently soloed. Another New Yorker in aviation is socialite Winthrop Gardiner, shown leaning on the upper wing of his new sport biplane. Not so pleasant, though, is the reason that N. H. Chong and N. A. Gin, Chinese laundrymen, are learning to fly (next picture). They are shown getting engine instruction at Rocky Mount, N. C. The five youths in the bottom photo came from outside the U.S. for training at Parks Air College.

Build Yourself a Baby Blimp

by MANLEY MILLS

Here the author gives some pertinent hints on the various details of a home-built or "baby" blimp. This is a decidedly novel—and expensive—hobby for the amateur.

WHILE successful home-built airplanes are an established fact, the lighter-than-air field remains practically untouched by amateurs. This, of course, is due largely to the prohibitive cost of such craft and the heavy maintenance expense. Yet, the idea of a tiny one-man dirigible presents an appealing picture to many flying fans. In the first place, a baby blimp would be in some respects much easier handled by a beginner than the average lightplane. Lateral control is not necessary and there is no stalling hazard. The comparatively slow speed of the blimp and the fact that it doesn't depend on forward motion to remain in the air, removes two of the greatest dangers in amateur flying. There would be plenty of time for the pilot to think in case of emergency. The average inexperienced pilot, when confronted with an emergency that calls for quick action, usually becomes confused and either does the wrong thing or doesn't do anything.

Motor failure would not ordinarily be a serious matter to the pilot of a baby blimp except in high winds. He could remain in the air until reaching a suitable landing spot, or might even make minor repairs while aloft. In fact, with favoring winds, it would be possible to stop the motor and drift along with the breeze in order to save gasoline. Or, by turning into the wind and throttling the motor to the proper speed, the blimp could be made to float, practically motionless, over any spot in comparative safety. In its hovering ability lies one of the greatest advantages of the baby blimp over a lightplane.

Incidentally, one of these little ships would provide quite a few money-making opportunities, one of the most attractive possibilities being its use as an advertising medium. The sides of the envelope make a good signboard, and it should attract much more attention than an airplane. Circulars and other advertising matter could be distributed with a minimum of waste while drifting over a city or a large gathering, vocal announcements being made, if desired, through a lightweight public-address outfit. Or, for night flying, a neon sign could be operated by a 110-volt A. C. generator coupled to the motor. Aerial mapping and photography is another possible source of income.

The accompanying sketches illustrate a suggested design for a miniature blimp. In working out the design, the first problem was to determine the smallest practical size for such a craft. The items of greatest expense are, of course, the envelope and the gas necessary to fill it. So, naturally, it is desirable that dimensions be reduced to a minimum. After much juggling of figures, dimensions indicated in the drawings—60 feet long, and 20 feet diameter—were arrived at. While they may seem large to anyone accustomed to the relatively small dimensions of lightplanes, they are very close to the minimum possible for a ship of this nature.

Further reduction in size would cut down the gas volume so much that the dead weight of the craft would exceed the lifting capacity. Since the surface-volume ratio becomes greater as dimensions are reduced, envelope weight is one of the factors that calls a halt to size reduction. In other words, the smaller the dirigible, the more the envelope weighs in proportion to the lifting capacity.

SO FAR as the editors can learn, only three home-built amateur dirigibles have been built in the United States. The problems involved are most interesting and decidedly different than those encountered by lightplane builders.

In addition to the construction of the blimp itself, the construction of a suitable hydrogen generator will be in line. Gas can be supplied from drums for test flights, but in the long run will prove too expensive.

Suppose we take, for example, the Goodyear *Puritan*. In length and diameter, our baby blimp is about half the size of the *Puritan*. The surface area is approximately one-fourth as much, but the gas volume is only one-eighth as much as the larger ship. So you see, envelope weight doesn't decrease in the same proportion as the lifting power.

Two-ply rubberized balloon fabric, which weighs 9.7 ounces per square yard, is perhaps the best material for the envelope. This cloth, colored silver on the outer surface, usually comes in 40-inch widths and sells for a little over $3.00 per running yard (whew!). That's the reason why even the smallest of baby blimps would be too expensive for the average person. In our case, the surface area of the envelope is about 344 sq. yds. The cost, then, for this item alone would be over $1,100. In view of the foregoing facts, a little reflection will show that, if the ratio of cost to load-carrying capacity is considered, the larger airships are much more economical. However, since we're not concerned with payloads, but are only interested in keeping the initial cost as low as possible, it's not necessary to look at the matter from this angle.

The volume of a streamline body, such as the baby blimp hull, is usually assumed as being 60 percent of the volume of a cylinder having the same length and diameter. Following this formula, the theoretical gas capacity is found to be 11,309 cubic feet.

At this point arises the question whether to use hydrogen or helium. First, however, it might be a good idea to review some of the principles of aerostatics. Any gas that is lighter than the air it displaces will rise. The lifting power of a gas is equal to the difference between its weight and an equal volume of air.

At sea-level and at a temperature of 32 degrees F., a cubic foot of air weighs about .0807 lb., while a cubic foot of hydrogen under the same conditions weighs approximately .0056 lb. The difference in weight—and, therefore, the lifting power—is .0751 lb. per cubic foot.

This figure applies only to chemically pure hydrogen. Such ideal conditions could never be obtained in actual practice, though, so a considerably lower value is used in calculating lift, thus assuring an ample safety margin.

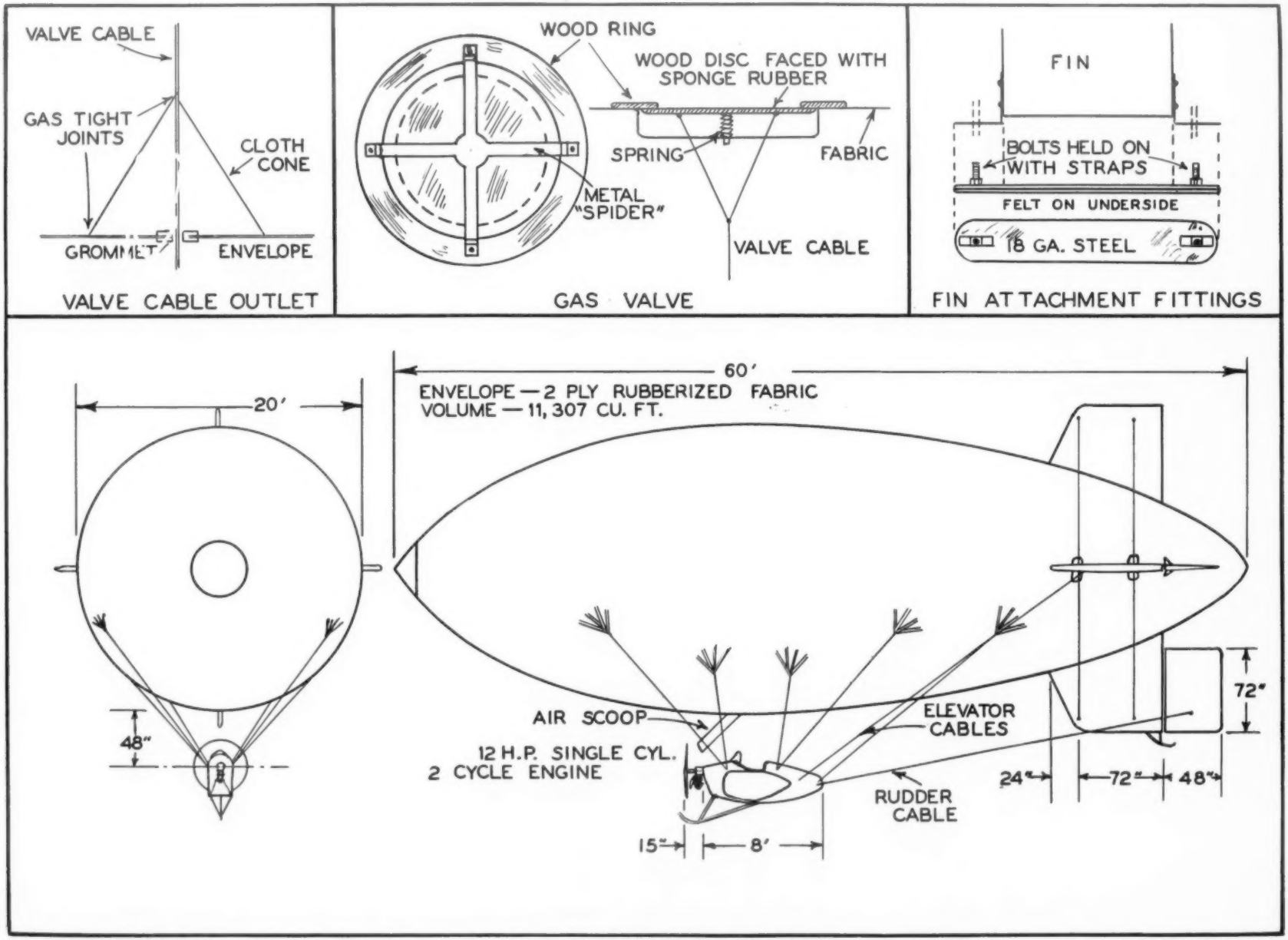
For practical purposes, the lift of hydrogen is usually figured at one ounce per cubic foot, which, being somewhat conservative, takes care of normal variations in gas purity, atmospheric conditions and other factors that affect lift. Based on this figure, the gross lift of our blimp will be about 707 pounds.

On account of diffusion, the air will gradually become mixed with the gas, reducing its lift and also increasing its inflammability. A mixture of 32 percent air and 68 percent hydrogen is explosive. The purity of the gas, for the sake of safety, should never be allowed to drop lower than 80 percent. As long as it remains above that figure, there is little danger of explosion if reasonable precautions are taken.

Incidentally, nothing but an open flame or a spark will ignite the gas anyway. Striking evidence of the comparative safety of hydrogen is found in the records of the *Graf Zeppelin*, and the many blimps that were used in patrol service during the World War.

The biggest point in favor of hydrogen is its relatively low cost. If bought compressed in cylinders, the price will range from $8.00 to $10.00 per thousand cubic feet. But, if obtained locally, or manufactured in a home-built generator, the cost might be as low as $1.00 to $2.50

(*Continued on Page* 54)


VALVE CABLE
GAS TIGHT JOINTS
CLOTH CONE
GROMMET
ENVELOPE
VALVE CABLE OUTLET
WOOD RING
WOOD DISC FACED WITH SPONGE RUBBER
SPRING
FABRIC
METAL "SPIDER"
VALVE CABLE
GAS VALVE
FIN
BOLTS HELD ON WITH STRAPS
FELT ON UNDERSIDE
18 GA. STEEL
FIN ATTACHMENT FITTINGS
20'
48"
60'
ENVELOPE — 2 PLY RUBBERIZED FABRIC
VOLUME — 11,307 CU. FT.
AIR SCOOP
12 H.P. SINGLE CYL. 2 CYCLE ENGINE
ELEVATOR CABLES
RUDDER CABLE
72"
24"
72"
48"
15"
8'

per thousand cubic feet, depending on the locality.

On the other hand, helium is so expensive that its use for privately owned airships is almost out of the question. A single inflation would cost anywhere from $300 to $500. Yet, it might be well worth the difference in price, because it would practically eliminate the fire hazard. Helium, in pure form, has about 90 percent of the lifting power of hydrogen, so that the gross lift of the blimp, when completely full, would be about 636 pounds.

Due to losses from diffusion and valving, a certain amount of gas would have to be added from time to time in order to keep the lift up to par. The amount of gas valved off for maneuvering or escaping, because of expansion, would vary with operating conditions, temperature, and altitude. But the loss through diffusion—that is, leakage through the fabric, or "osmosis"—would be constant, even if the ship is not flown at all.

Tests conducted in various experimental laboratories have shown that the volume of gas lost by diffusion through ordinary rubberized fabric will average about .00978 cu. ft. per sq. ft. of surface during a period of 24 hours. Accordingly, the daily loss for our baby blimp would be approximately 30.28 cu. ft. During the course of a year, this would amount to practically the entire volume of the ship.

If based on the percentage of the total volume, the yearly losses from diffusion would become smaller in the large size blimps, due to decreased surface-volume ratio. Still, the actual amount of gas lost would be greater, so the smaller ship would be cheaper to operate in spite of this fact.

The volume of gas valved off in maneuvering will depend largely on the skill of the pilot, and his ability to take advantage of changing weather conditions. For that reason, it's hard to give any definite figure for this item. The yearly average, however, will be about the same as the diffusion losses, it being assumed that the craft will be operated only under favorable weather conditions.

In other words, replacement of gas will amount to about 100 percent of the total volume every six months. Expressed in terms of cost, the annual gas expense, if hydrogen is used, will range all the way from $23 up to about $226, depending on how and where the gas is bought.

Getting back to constructional details, the first point to consider is the method of giving the necessary rigidity to the envelope. It is obvious that there must be some internal force to hold the fabric in shape, or it would collapse under the air pressure when the ship is driven forward. This is accomplished by placing the gas under pressure, which is the purpose of the ballonet, an air compartment in the lower part of the envelope formed by a loose cloth diaphragm. Air is forced into the ballonet, either through an air scoop located in the propeller slipstream, or by means of a rotary blower.

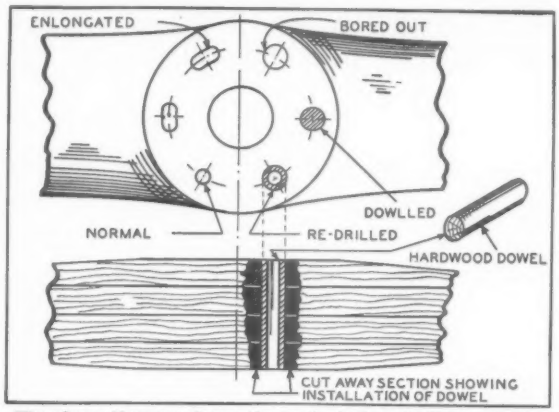
(*Continued on page* 94)

Useful Prop Kinks for the Amateur

by Lester Long

HERE is a little scheme that should save the boys a lot of grief, as well as a bunch of small change.

About 90 percent of the propellers made for the real light ships are built up of the softer woods, such as spruce, fir or even pine. These woods make very good props so far as efficiency goes, and are light and cheap. Being light in weight and having little inertia they reduce vibration.



The above diagram shows the method of replacing propeller bolts by dowels to increase the bolts' bearing surface.

The only serious failing they have is a tendency to enlarge or elongate the hub bolt holes. This trouble shows up especially on motors having large cylinders, such as the Szekely, Harlequin, Aeronca, etc. With such motors the explosions are heavy and widely spaced hence there is a marked tendency for the prop to oscillate on the hub.

Unless the bolts fit exceptionally tight and great care is taken the prop is almost certain to start working this way and, once started, nothing can stop it. After long use it may even show up in the best hardwood propellers. The holes tend to enlarge most on the motor side of the hub, thus making a sort of tapering hole. This does not particularly weaken the prop, but it is fatal to bolts. Because they are allowed to bend slightly they fail in a short time. Such bolts always break off right at the head.

There is another minor failing common in soft wood props. This is the pulling into the wood of the hub flanges. If the bolts are tighted a trifle too tight the flanges sink in, and each successive tightening draws them in farther until the prop is ruined. Because of this trouble pilots will leave the bolts rather loose, which is the very thing that causes elongation of the holes.

I once saw a prop that had enlarged the holes so much the prop had enough movement on the hub to actually catch fire, due to the friction as it rocked back and forth between the flanges. Of course that was an exceptional case, but it shows what might happen.

The kink shown in the sketch has the happy faculty of preventing or curing both these troubles completely. A glance should make it all clear. The scheme consists in boring out the elongated holes and fitting them with pieces of hardwood dowel stock.

For example, let's say we have a prop with five-sixteenths hub bolts. In most cases a half inch dowel will take care of the job perfectly. The prop is clamped on the drill table so it can't move and the half inch hole drilled through. If the hole doesn't quite clean up the oblong hole it makes no difference. All the holes are bored out this way.

The dowels increase the effective bearing area of the bolts so that the stress on the propeller wood per square inch is much reduced. This, of course, very materially reduces the tendency to crush the wood and to elongate the hole. Aluminum sleeves instead of dowels have been used on large props with success, but these are not for the amateur who should only use the wood dowels.

Pieces of good ash or hickory dowel stock are cut off the exact length of the thickness of the hub, and after being thoroughly coated with casein glue, are driven in the holes. The dowels should be a real snug fit, so that they have to be tapped in with a hammer.

After drying 24 hours the prop is redrilled in the usual manner. The hub is put in place with the holes centering on the centers of the dowel pins. The new holes are drilled right through the pins lengthwise, and the job is done, with a prop that is considerably better than new. Don't try to drill the dowels before glueing them in. It can't be done. And don't try to drill the holes without the hub as a template. That can't be done, either.

This plan cures both the troubles mentioned. The bolts now have a good hardwood bushing that can take a lot of punishment, and the lengthwise grain of the pins absolutely stops all tendency for the hub to crush under bolt pressure. A prop doctored in this manner is actually better than new so far as the hub goes, and it is very sound practice to so treat a brand new prop before it ever has a chance to go bad. These pins have still another virtue. They prevent the opening of the lamination seams at the hub which is a common trouble.

In case the seams have been opened before the repair is made, the prop should be clamped in a press while the pins dry, which will prevent the seams from ever opening in the future. This trick is easy and worth while.

I ALWAYS have wanted to write about aviation in the same manner I think of it. My continually intimate contacts with the industry have many times given me exclusive, sometimes even breath-taking, topics on which to report—and comment. When, by a fortunate coincidence, I was offered my much-desired editorial outlet by POPULAR AVIATION, I saw immediately that opportunity I have wanted for years. Consequently, my material here will consist of behind-the-scenes stories never printed elsewhere. Obviously, my name must remain an editorial secret—which probably will be best for us all. In other words, there will be *no* censorship.

So, gas on! Contact!

New Laws . . .

The Air Commerce Bureau's new regulations which become effective about the time this issue appears on the stands seem to indicate the art of regimenting airmen at last has caught up with the art of flying. . . . Undoubtedly the new laws will evoke moans from pilots and operators alike (aviation wouldn't be what it is without maverick individualities) but no one willing to be objective about them can raise a serious howl. . . . Something had to be done to fix definite responsibilities on parents, on student pilots, and upon instructors. . . . And this, broadly speaking, is exactly what the new laws do.

All too often this talk about new laws, new limitations, new obstacles to young hopes and aspirations is dull and uninteresting, but the new flying regulations are *hot* news to every person who is flying today or expects to fly in the future. . . . And consequently your aviation key-hole reporter proposes to take time and space right here to tell you something about the laws and about the intentions of the men who drew these laws.

Their approach was from the bottom. They tried to look first at aviation from the viewpoint of the new student. And what they found raised the hair on the heads of the investigators. . . . They learned that more than 50,000 young men and young women, many of them under age, were taking instruction, flying solo, building up flying time in the United States although only about 32,000 student permits had been issued by the Air Commerce Bureau.

Inquiry proved that the permits were being lent among groups of boys. One youth who passed a flight physical would lend his permit to any number of his friends so they, too, could take instruction without spending their $10 with the flight surgeon to obtain a check upon their bodily qualifications to fly. . . . And another neat trick which was, and undoubtedly still is, being worked, is that of a youth who under age and unable to obtain his parents' consent to flying has had friends forge a certificate of parental authority for him.

Still trying to make it easier for the beginner the law writers reduced the time for the amateur rating from 25 to 5 solo hours. The amateur license is abolished and instead the student receives a "solo flight rating." . . . And after he has had 35 hours of solo flight the pilot will be able to obtain a "private pilot rating" which will permit him to carry passengers on any airway and to any airport.

Editor's Note: POPULAR AVIATION *is proud to have induced "The Man Under the Hood" to write this new monthly column. Though it would be of great value to us to be able to reveal our columnist's true name, we cannot do so. First, because this writer is known throughout the land as a top-ranking aeronautical authority. Second, because he himself wants to be able to speak his mind freely—regardless of personal friendships or "taken-for-granted" indebtedness. Thus* POPULAR AVIATION *is enabled now to present American aviation's shortcomings, conspiracies and achievements without fear of pressure from "higher-ups." Thus* POPULAR AVIATION *presents the first exclusive monthly column of a man who is as close to aviation as the airplane itself (and is known almost as well) but whose identity we must regretfully keep confidential.*

All these requirements make it easier for the beginner. But along with them has come a number of supplemental regulations designed to protect the beginner in this period.

First of these is a rule that will require pilots who give instruction to pass an instructor's test. "We've got to be sure that the instructor knows how to impart information that is correct," one of the regulation writers said. . . . This test will make it possible to weed out bad instructors and also to insure that instruction is uniform.

In other words, students in California will be taught the same lessons in the same manner as students receiving instruction in Florida, or Maine, or Texas. . . . There's a military angle to this. All the young pilots will receive the same foundation instruction. In time of war the crop of civilian flyers can be taken up for military instruction at about the same point.

When an instructor begins handling students he cannot solo them in two hours and a half. Regardless of the progress made by the student he must receive at least eight hours of dual instruction before he is allowed to go solo. And the instructor signs a special new form stating that he knows the student has had the required dual time and is qualified in his opinion to solo before the student is sent away on that first ride alone.

The onus for anything that happens to the student thus is directly on the instructor. If his student smashes up an airplane and injures himself the instructor can be made to turn in his special instructor's license. . . . This will insure good instruction, and will eliminate the demanding of a solo flight by students who threaten to take their business elsewhere unless they get it.

Certainly no one can honestly say that such regulations are other than excellent. . . . Parents should welcome them, and so should every potential pilot who has a reasonable attitude toward himself, his family, and other flyers. . . . So much for the new air laws.

Ashes . . .

Have you heard the story of the Sperry Gyroscope expert who had to pick a newspaper copyreader out of one of the latest model gyro pilots? . . . It really happened. . . . The copyreader died and left a request in his will that his body be cremated and his ashes strewn from an airplane.

The kind hearted publisher of the paper, proud owner of an $80,000 Lockheed plane, offered the equipment for the execution of the last section of the request. . . . The ashes were taken aloft and a dear friend of the copyreader who knew nothing about airplanes tried to dump the little iron urn full of the human residue out a rear window.

His aim was poor and much of the ash remained in the ship where the natural suction toward the cockpit—the windows were open because it was a warm day—drew the fine powder in that direction.

It is reported that within a few

(*Concluded on Page* 90)

How Do You Pronounce That Name?

IF there's anything that is liable to grate on one's nerves, it is the gross mispronunciation of names. In the aviation industry, for instance, one can have a fairly miserable conversation with someone who insists on saying "aviation" in any form except the correct way: AY-vee-ay-shun. The capitals denote the syllable to be accented. No, that first syllable is not pronounced so that it rhymes with "hat". It's "ay" like in "hay."

But that's only a beginning. The biggest aeronautical pain-in-the-neck is the diabolic way some people have of pronouncing the names of certain airplanes or other things pertaining to aviation. Grand-daddy of all these neck pains probably is Waco.

Now, no matter how much the Waco people might try to educate America's aviation industry, there still are thousands who insist on saying it "Wayko" or "Wako" (like in "cat"). The fact has been pointed out time and time again that Waco is pronounced "WAH-ko" but it apparently makes no difference. No, there's no connection between that airplane company and Waco, Texas.

The trusty Aeronca has been insulted in all forms. Notwithstanding, there's only one legitimate way to address that airplane: Air-ON-kah.

Another old aeronautical name that is inclined to make Tony Fokker tear his hair is that on the airplanes bearing his name. It's not pronounced like "roper" nor does it rhyme with "cocker". It's "FAW-ker."

Cessna has been given several different variations. But it's really pronounced Sess-nah, with the greatest effort on the "Sess."

Though his company's only comparatively new, Roy Grumman has already been well pounced-upon by aviation's verbal contortionists. No, it's not "Grooman." It's "Grum" like in "drum" with the accent on the first syllable.

The accent in Seversky goes in the middle syllable: Se-VER-skee. Sikorsky is practically the same: Seh-KAWR-skee.

The "Vul" in Vultee rhymes with "hull." The emphasis is on the "tee": Vul-TEE.

Harold Pitcairn pronounces it PIT-kayrn.

Vought rhymes with "taught."

And don't let anyone tell you different. That windmill up there is an auto-JEYE-row.

Luscombe sounds like LUSS-kum.

Even the American engines have their share of defamation. The Lycoming engine, for instance, has been called all sorts of things. Some folks just won't say it just the way it looks: LIE-ko-ming.

And it's Le BLOND.

The famed Menasco is referred to as Men-AS-ko.

Locates the Center of Gravity

A VERY remarkable computing machine has recently been devised by Lewis W. Imm of the U. S. Bureau of Air Commerce. This is the "Librascope" or visual balance indicator which will accurately indicate the center of gravity of a loaded plane.

This instrument will quickly tell whether the plane is nose-heavy or tail-heavy without the necessity for long tedious pencil and paper calculations. It takes into account all of the loads, structural or otherwise, and gives the answer by means of the dials at the top of the panel.

By the means of the Librascope, it is possible to determine the proper load distribution at the airports when loading an airliner with mail and express matter so that the plane will fly in the proper "trim" and with the least possible application of the control surfaces for this purpose.

The Librascope also is of service to the engineer in laying out the distribution of the loading in a new type of plane, a calculation that may take many hours if performed by the pencil and paper method.

Here is the new Librascope's first commercial model. This one was used on calculations for the new Lockheed "14" airliner.

It's a Way We Have at 'ole Rantoul

CHANUTE FIELD, the Army Air Corps technical school at Rantoul, Ill., may generally be thought of as a stodgy old Army base that reeks with unromantic engines, cameras and other technical but dry phases of American military aviation. But don't kid yourself . . .

They call it the "Wing Chorus" and, believe us, those Army lads at Chanute now have worked themselves up one of the swankiest men's glee clubs in Illinois.

Some informers say it all started when officers complained of men humming and sometimes bursting into full (and sometimes off-key) song right in the midst of some highly technical Air Corps project. But however the thing actually did start, it's going full blast today with more than 50 voices in full harmony (more or less) under the able direction of Chaplain Wallace I. Wolverton.

Despite any first impressions, these hairy-eared soldiers are really popular. The "Wing Chorus" made quite a musical name for itself in (of all things) concert work! During the past year, we'll have you know, the Air Corps boys from Chanute have given 15 concerts. For this year they're well booked up with return engagements and new "business".

But these airmen don't only sing. In the chorus there is such program relief as a tap dancer, a soft shoe dancer, two pianists, comedians and a master of ceremonies. Then to top it off, four enterprising soldier-yodelers branched off and now there's a side organization known as "The Ailerons" quartet. And when the whole bunch of aeronautical musicians want to take things easy by themselves without a bunch of doting admirers to congratulate them on a recent concert, the lads retire to "The Broken Wing Inn", a broken down house out in the country near Chanute Field.

Ah, these airmen!

Aviation, Blondes and Lingerie

by WILLIAM L. HOPSON

Here we have the exceedingly entertaining yarn of a cow-pasture flying circus that got mixed up with a bit of pale pink lingerie and—but you must read the rest . . .

YOUR rattle brained correspondent once read about a small town gentleman who refused to go on a jury, stating that he didn't believe in circumstantial evidence.

It seems the unfortunate gentleman had once had an old maid neighbor who disliked him as much as he disliked her. But one Sunday morning, being in a Sunday mood and seeing her having difficulty separating her milk cow from the calf in the pen, he decided to forget their differences and give her a hand.

The old lady was suspicious but stood by the gate while he drove the calf in the barn and had her open the gate. Unfortunately, that bull calf had ideas too and made an unexpected bolt, ducking past the Good Samaritan who was standing inside the door. The gentleman grabbed at its head, missed and came up with a good handful of tail with a plunging bull calf fastened to the front end.

To make a long story short, when he came flying out of the door with all the speed of a Boeing pursuit taking off downwind, and still holding that bull calf by its nether appendage, the old lady swore and be damned that he did it to spite her.

Your correspondent knows exactly how the poor man felt for he, too, has been a victim of circumstances. Not through a rambunctious bull calf, but of Fate, a 2,500-foot free fall with a Russell pack chute, two good looking blondes, a crackpot pilot and a crackpot gentleman from Oklahoma with a slight touch of kleptomania. (Never mind about looking it up, gentlemen, because I had to. It means: a morbid impulse to steal.)

Anyway, to straighten things out a bit let me begin thus:

Early one morning on July the third, and not too many Julys ago, three of us came banging in over a small country hamlet in a yellow Curtiss *Robin*. Down below in the town's single street were flags, carnival tents, merry-go-round, etc., and all the rest of it. Flying the *Robin* was a fellow named Gordon. In the back seat were myself, with the Russell between my feet, and our Indian who owned the *Robin*.

A word here about Cliff. He really was only one-eighth Cherokee; but I, being a smart aleck anyway, had nicknamed him Squatting Heifer. He'd had the misfortune to see a friend take in 65 bucks in three hours with a rebuilt old Swallow, had figured the public would really go for a nice new job, had bought the *Robin*—and had never made expenses barnstorming with it.

There was a level pasture a half mile or so south of town which we'd spotted from the air a few days before, and we glided out and landed. We'd left the home field early and intended going in town, getting a room at the hotel, eating breakfast, and then go back out to start hopping passengers.

While we were locking the ship a few cars drove up. In one of them were a couple of good looking blondes. Remember those blondes, gentlemen, because the plot now begins to thicken.

The "leap for life"—at $25 per leap.

We all three saw the blondes at the same time and by the time their coupe rolled to a stop, Gordon had sidled off in a casual stroll, obviously to sell a couple of flight tickets.

"Well, the polecat is off again," quoth Squatting Heifer disgustedly to me, as I stood with 50 pounds of chutes slung over my shoulder waiting for him to lock the cabin door and pick up our suitcases. "Betcha ten bucks he dates 'em up before we get to town. I wish he'd leave the dames alone an' tend to business." (It should be stated here that Squatting Heifer was more Scotch than Cherokee. Bear *that* in mind, because it was the cause of my trouble!)

I didn't take the bet, and a few minutes later we were on our way to town in another car. Gordon had gone on ahead with the two blondes.

We did a fair passenger business that day. When we weren't busy our hero pilot spent his time with a Number 11 planted on the running board of the girls' coupe, telling the starry-eyed females all about the life of a birdman—the louse! I didn't meet the two, not caring to be rung in on a party. I'd met a man during the day who claimed he was an old time airman and chute jumper and had a brand new Irvin back pack.

He worked for a mining company about 30 miles out of town, and had told me that if I'd drive out to the mine with him that afternoon about sundown to attend to some horses there, he'd sell me the chute for $75. Naturally, I snapped up his offer; though I should have known by the line he handed me and the fact that he was drunk that he was a phoney.

Anyway, during a lull in business that afternoon our Clark Gable came ambling over to where I was vainly striving to extract three bucks from two farmers for a flight. He had that kind of expression on his face that a tom cat gets trying to get his head into a freshly opened but empty salmon can.

"Well, Tex, it's all fixed," he chortled a moment later, after calling me aside. "They've got a friend and the six of us are going out tonight to ring doorbells and throw rocks at little puppies."

"Nothing doing, Romeo," I told him, though it pained me to refuse. "I've got a deal on for a new Irvin chute that's too good to miss," and I explained about the man I'd met.

"But you can't do this to me," protested John Barrymore indignantly. "Look at all the trouble I've gone to fixing things up. Besides, this baby is a combination of Garbo, Bebe Daniels, and Talmadge rolled into one and wants to meet you."

The crux of the matter was that I told him to go jump in the lake with his blondes and went on selling tickets—being careful not to go near their car. (I was afraid I might weaken at the last moment.)

The guy who was supposed to own the chute had been pretty much oiled up all day and when I went in to meet him that evening at sundown he was stewed to the eye-balls and we didn't get away until about eight o'clock. We finally piled in the mining company's new Model A Ford and hit out for the mine All the way out he kept telling me what a great flyer he had been in the war, but when I brought up the subject of the chute he kept evading me.

It was only after we got out to the mine about nine that night that I found he had no chute. He merely knew where he could get one—and he appeared down-

right surprised when I had thought otherwise.

So very disgustedly I helped him feed and water the stock and we came back, arriving at the hotel about 11. I went up and went to bed. Two or three hours later Gordon and Squatting Heifer came in, slightly oiled, and after playfully pulling off all the covers from my skivvy clad form and throwing a glass of water on me, they turned in.

I have said that the gentleman of Cherokee extraction had a slight touch of kleptomania. Perhaps I should have said he had a hobby of swiping things from every hotel in which we had stayed. He had more towels than the Pullman company, none of them alike. He also possessed the finest collection of salt cellars I've ever seen—about 30 of them.

I got up early the next morning and while I was dressing Squatting Heifer woke up and got out of bed. Clark Gable still lay wrapped in the arms of Morpheus, snoring blissfully and also quite loudly. We dressed and went down the hall.

And then, gentlemen, the trouble that was about to descend upon the innocent head of your hair-brained correspondent had its inception!

As we reached the head of the stairs Squatting Heifer saw a neatly folded bundle lying on the top of the banister. On top were two new window curtains of some bright colored cloth, and underneath I could see a clean sheet. Had I known what someone, presumably the maid who had left it there, had placed in between I would have resorted to force to make the gentleman from Oklahoma leave the bundle alone.

"At it again, hey?" I snorted as he calmly tucked it under his arm and started down the stairs.

"Hell, I got to get my money's worth someway," defended the culprit as we went out into the street. "That room wasn't worth the three bucks we paid for it. These'll make swell polish rags for the ship."

You can't argue with a mug like that, so we had breakfast and went out to the field. Once out there Squatting Heifer undid the bundle preparatory to cleaning up the ship a bit. There were two small curtains, all right. And there was a sheet, too. And lying in between was a dainty pair of pink silk something-or-others with fancy trimmings around the edges that was the masculine equivalent of a pair of skivvys.

Being a smart aleck, I promptly grabbed up what undoubtedly had been the pride and joy of the hotel maid and began polishing the ship with them. Squatting Heifer tore the sheet into four pieces and began massaging the other side. When we finished I absentmindedly stuck the pink undies in a coverall pocket and forgot about them.

An hour or so later Romeo showed up and we began hopping passengers. I had been guaranteed 20 bucks to

(*Concluded on page 76*)

the NATIONAL AIR BOARD Says...

Dr. Alexander Klemin, Chairman

AT its seventeenth meeting the Air Board took up the eminently practical question:

IS AVIATION PAYING ITS WAY?

In this discussion the lead was taken by two well qualified men. These were A. P. Taliaferro, Jr., of the Aeronautical Securities Research Corporation and S. F. Christy of National Aviation Corporation, a well known investment trust.

MR. TALIAFERRO—OPTIMIST

The transport companies, said Mr. Taliaferro, charge to current expenses such items as new radio, the training of pilots, experiments in sub-stratosphere flying and other developments. In reality some of these expenditures become assets. Again the depreciation of such planes as the Douglas DC-2 is calculated on a four year basis. A life of four years for some of the old time stick-and-wire bases was all they were good for. But a modern, all-metal airplane will give perfect service for nearly twice as many years. If the transport companies changed their accounting systems to meet these criticisms, their books would show far larger profits than at present.

Unfortunately, the last session of Congress resulted in no legislation for the improvement in status of the transport companies. Many bills were introduced but none passed. Yet what our airline operators need badly is the possibility of obtaining a "Certificate of Convenience and Necessity." Bus lines when they start in business often lose the bulk of their capital, but feel that they have done well, when at the end of a pioneering period, they receive such a certificate and know that they have earned permanent right to operation over a given territory. When airlines can likewise establish a definite sphere of influence, their books will justifiably show assets to offset pioneering expenditures. And again their true profits will increase. For airplane manufacturers, Mr. Taliaferro saw real prosperity in actual being.

For the year 1937 total airplane sales will amount to $115,000,000, an increase of 50 percent over last year. On June 30, 1937, unfilled orders amounted to $130,000,000 which will give ample carryover for 1938 and even 1939.

Sales of commercial airplanes alone for the first six months of 1937, amounted to $10,000,000, with 1,061 planes delivered as compared with 656 planes and $5,500,000 of sales in 1936.

The manufacturers of small airplanes, (Taylor *Cub*, Aeronca and others) cannot fill their orders, and the total number of small ships to be delivered this year will amount to 1,500 or even 2,000. In 1938, the number of small planes sold to cash customers may amount to 4,000—a figure which the industry would have considered fantastic a few years ago.

Exports to foreign countries now amount to 32 percent of our total airplane output and are constantly increasing. Since the price for exported airplanes can be considerably higher than for those delivered to the domestic market, the margin of profit in airplane manufacture has thereby increased considerably.

The peak of labor troubles in the aircraft industry has probably passed, new bookings are at firmer prices to cover higher wages and the increased cost of raw materials. The House Naval Affairs Committee has reported favorably on the abolition of the Vinson Act which limits profits on Navy orders to 10 percent. Manufacturers with a large amount of business on hand are stiffening in their attitude to the Army Air Corps and will not bid blindly on experimental competitions unless their devel-

(*Concluded on page 72*)

"Sales of commercial airplanes alone for the first six months of 1937 amounted to $10,000,000 with 1,061 planes delivered as compared to 656 airplanes in 1936."

The Latest in Aviation Inventions

by WILLIAM GILMAN

Don't think the inventors haven't been hard at work all these months. Though we have neglected to mention their efforts, much has been done. Here are the latest.

THE parade of aviation inventions goes merrily along and, with the present emphasis upon safer flying, it is significant to note the newest refinements in engine control. This is indicated by several patents granted recently at Washington.

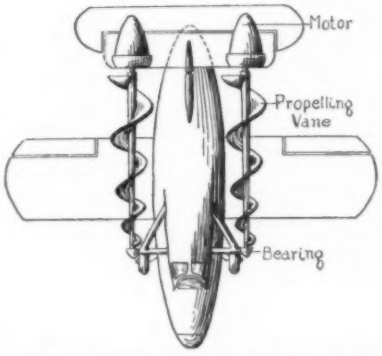
One of these represents real progress in overcoming that bugaboo of cold weather flying, freezing in the carbureter. The idea is to give the carbureter a shot of "anti-freeze" when ice begins forming.

Patent No. 2,067,595 was assigned to the Reed Propeller Co., Inc., Garden City, N. Y., by the inventing engineers, Kenneth Brown, Willard Goodman and Donald Lowman. It was applied for on August 14, 1934, and one claim was allowed by the U. S. Patent Office.

In their outline, the engineers cite the danger in having a motor splutter or go dead because of ice forming in the carbureter. In changing from liquid to vapor, aviation gasoline absorbs much heat in the carbureter and causes a big drop of temperature there. As a result, the fuel mixture is often below the freezing point of water even though the atmosphere through which the plane is flying may be 50 degrees above freezing point.

This causes moisture from the air to freeze out and deposit in the carbureter. Inoperative throttles are the result. The traditional method of dealing with this trouble, Brown and his associates state, has been to pre-heat the air before it mixes with the gasoline. But this requires a bulky heater and moreover, there is a power disadvantage in having the gas-air mixture warm when it enters the cylinders.

The inventors' method (see Fig. 1) is simply to spray alcohol into the air-scoop entrance. It mixes with the incoming air and forms an anti-freeze mixture with the water vapor. Actual experiments, the inventors state, show that a small quantity of alcohol continuously injected will prevent the formation of ice. But more important—even after the carbureter has become seriously iced up, the alcohol spray can be turned on, and in a few seconds, the ice is gone.



This device, the inventor believes, will eliminate much "propeller inefficiency."

Brown and his associates state that their de-icing system works best by having the alcohol in vapor rather than liquid form when it enters the carbureter. The mechanism works this way:

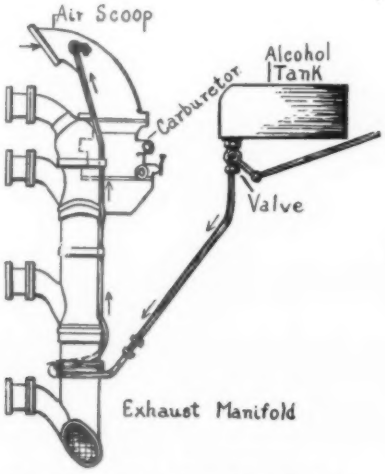
When the pilot senses a loss of power and suspects ice formation, he opens the alcohol tank valve for a few seconds. The alcohol flows down through a pipe and through a coil around the exhaust manifold. The heat here vaporizes the alcohol which then is piped into the air-scoop entrance. Here it joins the incoming air. When the anti-freeze mixture enters the carbureter, the ice immediately begins loosening and passes on to the cylinders. After one or two seconds of erratic running, the engine is back to normal and the alcohol valve is closed.

Another patent assigned to the Reed Propeller Company, the inventor, Roland Chilton, aims at improving operation of the air-cooled engine. Patent No. 2,067,597 shows this is done by using a finned cylinder. The fins, made of a light, inexpensive substance like an aluminum alloy, are attached to the cylinder, made of high-strength steel.

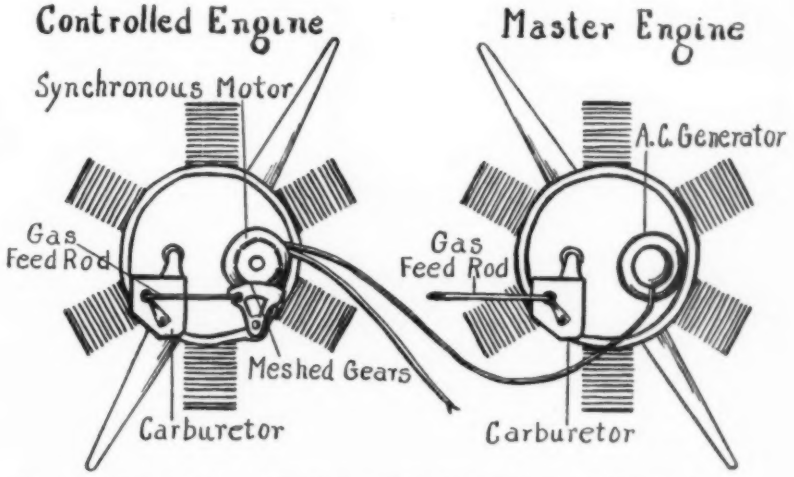
Still another patent dealing with the air-cooled engine went to the United Aircraft Corporation through assignation by the inventor, Rex Beisel. The invention, No. 2,067,041, calls for a hand crank at the side of the cockpit, which operates a screw mechanism, this in turn operating cable rods running to each air control flap mounted at the trailing edge of the engine cowl. A turn of the crank causes each flap to open or close in unison. Sixteen claims were granted Beisel.

The troubles of the man piloting a multi-engined craft and trying to keep the motors running at the same r.p.m. are treated with electricity by W. S. Berry in a patent No. 2,066,819, assigned to the Pioneer Instrument Co., Inc., Brooklyn, N. Y. Five claims were allowed on his synchronization device.

Berry points to the value of his invention in that there is excessive vibration and a resulting weakening of the plane's structure when its engines are not running in unison. His idea is to relieve the pilot of fumbling around at his controls, trying to synchronize the



The latest in aircraft de-icing devices.



Because airline pilots have difficulty in synchronizing engines, this idea was born.

motors by hand, and thereby give him more time for other pressing duties.

Assuming that the plane has two motors (see Fig. 2), here is how Berry's device works. The pilot sets the speed of his "master" engine by hand. Attached to this engine is a small alternating current generator, which produces current having a frequency corresponding to the speed of the master engine. At the other, the "controlled" engine, is provided a small "synchronous" motor.

The controlled engine runs the rotor of its small auxiliary motor at a correspondent speed. This means that the electro-magnetic field produced by the revolving rotor alternates at a frequency corresponding to the speed of the controlled engine. Now around this rotor is a stator which is normally stationary but can rotate slightly. This stator is fed its electrical energy by the alternating current from the small generator on the master engine.

When the controlled engine runs at the same speed as the master engine, the alternating current field in the stator of the synchronous motor is reversing at the same frequency as the field produced by the rotor. There is no change in phase relation between stator and rotor, hence no tendency for the stator to make use of its capacity to rotate slightly. But if the controlled engine's speed changes in respect to the master engine's speed, whether faster or slower, there will be a change in phase relation and the stator will move in one direction or another from its normal position.

This slight movement is used in the invention to open or shut the carbureter valve on the controlled engine, as the case may require. Then, as the controlled engine comes into synchronization with the master engine, the stator gradually moves back.

The invention applies similarly to more than two motors. In a tri-engined plane, with two "controlled" engines, each has one of the small, synchronizing devices.

Another patent (No. 2,068,300) recently granted ended years of litigation for the inventor, Capt. J. V. Martin, one of America's pioneer aeronautical engineers. He originally applied for the patent on his modern, streamlined plane back on Nov. 16, 1923. He went through federal courts with his fight to force the Patent Office to grant him rights to all the features he claimed to be novel. He acted as his own lawyer, explaining during proceedings that he had been "harassed by poverty." But the case was finally thrown out on legally technical grounds and Martin satisfied himself with accepting a patent on eight of his original claims.

Martin's invention eliminates parasitic structural resistance to the plane's flight by such features as retracting the wing braces and chassis, by completely enclosing all bracings and controls within the wings, fuselages and control surfaces, and by arranging the radiator surface to coincide exactly with the external skin of the fins. It also shifts the weight of the

(*Concluded on Page* 74)

Bossi Is His Own Engine

Peter Bossi himself—the dynamic airman who pedals his way through the air.

PETER BOSSI has achieved fame by making a record flight on his self-propelled airplane. According to our correspondent, the record now stands at 42-feet while numerous 50-foot flights have been made unofficially.

Now, while 50 feet, at 3-feet above the ground, is not comparable with a transatlantic flight, yet it is really a great achievement when one acts as one's own power-plant. If our readers do not believe this statement, they will second the motion when they try it.

A New Headset

A VERY efficient microphone and connecting cable has recently been devised for airplane service. It is highly directional, picking up a minimum of external noise.

The new mike, complete with switch and cable. Great efficiency is claimed.

The Maisoneuve Gliding Club and Its Activities

AFTER years of model building and dreamship drawing in the spring of '35, our group decided to progress to gliding. At that time we possessed much more enthusiasm than money.

Of course, the inevitable cracked-up glider was found and was bought for $10 —which we borrowed.

The money end was quite a problem to surmount at this early date because only one member was gainfully employed and our fees were $1.00 per year and five cents per week.

We decided to run a dance. And after provincial taxes, civic taxes, Federal taxes, amusement taxes, war taxes, sales taxes and surtaxes were paid we found that we had made money enough to buy one board which we had sawn up to make the tail assembly. We found it much cheaper to buy our wood this way, in large planks and two by fours, and get it milled ourselves.

Immediately we decided to run another dance and yet another 'till we found that we were spending more time and money running dances, supporting governments, orchestras and halls than we were building gliders.

Our glider was made in one half of a two-car garage and if more than two members turned up at one time we had to transfer operations into the alley. We never really appreciated before how many people actually had business there until we started to assemble a wing. Icemen, coalmen, garbagemen, peddlers, junk dealers, one of whom even offered to buy the thing.

The ship is a Rhön Ranger with our own modifications, viz., full depth wing spars and built up skid covered with plywood. Our first flights testified as to the advisability of this. By the way some advice to those who are building their own ships in a small space: don't hurry too much because you may find yourselves with two right wings.

In September, we at last found we had a primary glider ready to fly—so we flew it. The only things any of us knew about flying a glider was what we had read in the various popular magazines devoted to aviation. We used war surplus shock-cord until it broke, injuring two of our members and a few well-meaning bystanders.

After that we "graduated" to motor towing if and when anybody was kind enough to tow us, in other words we "thumbed" our way into the air. Several times we assembled the ship and "thumbed" all day without success. Now one of our members has a car, poor fellow.

Between repairs we have had two fairly successful seasons of flying. Every member of the club, except one, has flown and landed normally at least once. (We have no official observers here as yet so we have no certificates.)

We have a possible soaring site (it's

(*Concluded on Page* 90)

More on Landing Gear Design

by CONRAD J. MORGAN

Here is another of the author's comprehensive articles on landing gear design and construction. Here he discusses the "new" tricycle gear that is returning to favor.

THE modern trend in aircraft landing gear design leans toward the adoption of the tricycle type of chassis.

The benefit inherent with this kind of chassis has been fully investigated by the Material Division of the U. S. Air Corps. The results of this investigation have been so satisfactory that in the future designs of large aircraft will undoubtedly incorporate this type of landing gear. A major advantage, coincident with the application of this kind of chassis, is its freedom from the tendency to ground loop under adverse conditions.

The basic fault with the conventional type of chassis is the impossibility of applying high braking forces and the tendency to ground loop under normal landing conditions. Although individually braked wheels are now utilized, the tendency to ground loop cannot be entirely deleted from the conventional chassis. The fault lies in the inherent design of the landing gear itself and which is difficult to remedy.

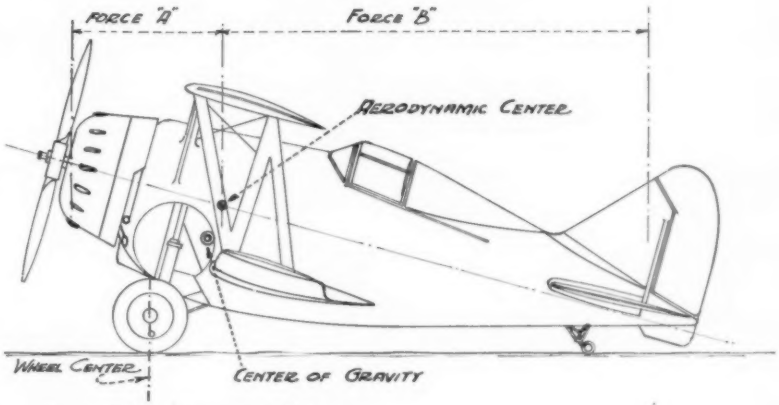
The conventional airplane when it is rolling along the ground at a high rate of speed is in many cases directionally unstable. This condition is noticeable in many civilian aircraft of low and medium weight and tax the ability of the pilots in many instances to arrest the forces which tend to cause autorotation of uncontrolled nature while rolling along the ground.

It is to this class of airplanes to which this discussion applies. A ground loop during landing is dangerous and on many occasions serious fatalities have resulted from ground loops which could have been prevented with a redesign of the chassis.

Certain classes of airplanes are known to be notorious for their tendency to ground loop in the hands of pilots of limited experience. Safe civilian flying cannot be achieved until ground looping tendencies are engineered out of the conventional airplane.

The average airplane in the hands of student or pilots of limited experience is prone to ground loop if landed in a slight cross wind as is the case at many airports. The only control the pilot has at his disposal is the braking acting upon the wheels and the aerodynamic forces which in many instances prove to be ineffective.

Therefore, the vital point to consider is to design the landing gear so that ground looping is impossible and cannot start. The basic causes of the tendency to ground loop are given below in the order of their importance:



FORCE "A" IS ½ OF FORCE "B."
FORCE "A" RESISTS ACTION OF CROSS WINDS ACTING ON VERTICAL FIN.
THE MOMENT OF FORCE "B" CAUSES GROUNDLOOPING IN CROSS WIND LANDINGS AND IS 3 TIMES THE MOMENT OF FORCE "A".
NOTE THE LARGE MOMENT TENDING TO CAUSE ROTATION ABOUT WHEEL CENTER IN A CONVENTIONAL LANDING GEAR.

(1) General directional stability characteristics.
(2) The aerodynamic center of the fuselage.
(3) The location of the wheel center on the longitudinal axis.
(4) The amount of the projected flat plate area aft of the aerodynamic center.
(5) Propeller torque.
(6) Tire and shock strut deflection.
(7) The tread of the landing gear.
(8) The character of the ground at the airport.

Aircraft, while rolling along the ground at a moderate rate of speed, have a minimum of directional stability and tend to head into the wind during a cross wind landing. In normal landings into the wind no harm is done on this account. However, during a cross wind landing this tendency to weathercock into the wind necessitates hard opposite control by the pilot as well as braking.

The airplane while it rolls along the ground acts in a manner similar to the usual ground vehicle but it will react to forces readily which overcome its normal directional stability characteristics.

The effect of aerodynamic control is very limited and in many cases the sole arresting force to turning upon the ground rests with the use of individually controlled brakes. The prevention of the incipient ground loop can only be acquired by the pilot through practice and in most cases this is not available to the average student or civilian pilot.

In taxiing, or rolling in from a landing, the stabilizing force is purely aerodynamic and is a function of the vertical tail surfaces and their disposition about are aerodynamic center of the fuselage In cross-wind landings the vertical surfaces fail to perform the correct function and herein lies cause for the trouble.

The aerodynamic center of the fuselage in most cases lies close to 25 per cent of the length of the fuselage measuring from the nose of the airplane. It is about this point which the directional stability forces act about while rolling along the ground. The point is positive when the point lies behind the center of gravity of the fuselage and negative when it lies ahead of the C. of G.

The fact that on most aircraft the aerodynamic center of the fuselage lies aft of the center of gravity, and that the projected side flat plate area is large, gives birth to a very high turning moment in a cross wind when it acts upon the vertical tail area.

Similarly, the fact that the aerodynamic forces tend to diminish as the airplane rolls along the ground to a stop, while the cross wind force acting upon the side area to the rear of the aerodynamic center, tends to remain constant, generates a ground loop. The ground loop has a radius whose dimension is governed by the rolling speed of the airplane, its inertia, and value of the displacing forces.

Modern aircraft are streamlined to a very high degree. In such designs the rudder area above the fuselage is excessive in comparison to the side area of the fuselage. This produces a turning

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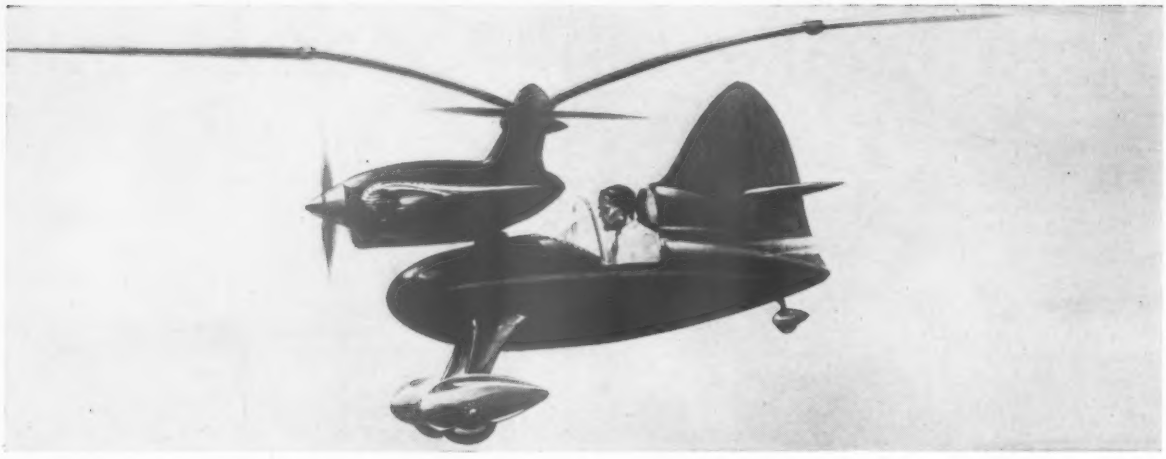

A Rotor-craft Symposium

Though the autogiro's production in this country has dropped almost to extinction, the subject of rotor aircraft is nonetheless important. Here the capable members of the National Air Board deal exhaustively with this subject.

WE have heard it said by airplane people that the death of Juan de la Cierva marked the end of rotary airfoil development. While de la Cierva's loss is irreparable, recent events have shown remarkable progress in rotary aircraft. The 16th meeting of the Air Board, at which some of the most distinguished exponents of this art were present, completely dispelled this erroneous notion.

There were present at the meeting W. Wallace Kellett, president of the Kellett Autogiro Corporation and his associate, Mr. Wilson; Gerard P. Herrick, the inventor of the "Vertaplane" and his erstwhile associate, Ralph MacClarren; and E. Burke Wilford of "Gyroplane" fame, who is, of course, a member of the Air Board. A letter from Agnew Larsen, chief engineer of the Autogiro Company of America, followed statements by these authorities and completed a remarkably interesting symposium.

The Autogiro in Army Service

We have become accustomed to thinking of the Air Corps as something completely independent of ground troops, as operating in independent squadrons, and as only helping artillery or infantry on special call. It would appear today that the autogiro is a military weapon of the highest utility which can operate in the closest possible fashion with an infantry regiment or a batallion of artillery. The autogiro can perform military duties such as low altitude reconnaissance or artillery observations which are beyond the safe powers of airplane and other tactical problems are being solved by its use, which the closest students of the military art have not foreseen hitherto. The better artillery observation possible with the autogiro, allows more rapid bursts of fire and this is equivalent to increasing the power of the artillery. Reconnaissance ahead of cavalry with a 'giro virtually makes the dispatching ahead of small bodies of horsemen unnecessary. Maps do not give artillery men the detail information on terrain which military 'giros are capable of furnishing at short notice. All in all, the military autogiro has now definitely proved itself an indispensable aid to our army.

The Army Air Corps has given its stamp of approval to the autogiro in the one unanswerable fashion, namely by placing orders for its construction. As Mr. Kellett pointed out, this will give to rotary aircraft that indispensable economic support which will allow further development to be carried on in adequate fashion. In particular it should allow more men to be employed and trained in autogiro design. At present, Mr. Kellett said, there are not 20 men in the United States capable of doing engineering work on 'giros as compared with the hundreds trained to difficult work in the airplane. Progress in rotary aircraft will become more rapid only as more talented engineers turn their efforts in this direction.

How Vulnerable is the Autogiro?

Captain Depew, besides being an airplane pilot of considerable distinction, has made many 'giro flights and has a real respect for their utility and future. He brought up the vital questions: How vulnerable is the giro and can fight back?

Mr. Kellett and Mr. Wilford made excellent rejoinders. First of all the autogiro is much less vlunerable than the captive balloon or even the motorized balloon. At an altitude of less than 2,000 feet it is practically immune to power dive attack by airplane. How about fighting back? The autogiro can raise its nose so high without stalling that a front gun becomes a real weapon. Second, a gun could be mounted at the axis of rotation or synchronized with the blades so that fire overhead would be possible. Third, the maneuverability of the 'giro is extraordinary; it can make turns in a space and with a radius of turn which is extraordinarily small. It would appear quite definitely that the 'giro is *not* defenseless, nor nearly as vulnerable as airplane people would have us believe.

The Rotor as a Parachute

Augustus Post made the interesting suggestion that a rotor might be used as a parachute which would neither foul nor tear, would be positive in its action and be capable of better guidance on its descent. Mr. Kellett thought this suggestion a fascinating one, meriting thorough exploration.

The 'Giro in Roof Landings

Mr. Post brought up the question of roadability. Undoubtedly the Pitcairn Autogiro Company has been successful in producing a roadable autogiro. Whether roadability is really important is another matter. At the moment it would perhaps appear more important to secure higher performance from the rotor and advance its flying qualities generally. In particular for roof top landings greater maximum lifting capacity and better all round performance are necessary. Why asked Mr. Post did the successful roof top tests on the Philadelphia post office apparently lead nowhere. Simply for lack of further experimentation, in Mr. Kellett's opinion. The Haines Bill, which calls for the letting of contracts for roof top landings by the Post Office Department, may revive such application of rotor aircraft very speedily. At this juncture a letter was read from Agnew Larsen, which

(*Continued on Page* 84)

Beams and Bending Moments

by RAOUL J. HOFFMAN

The author herewith presents a simple and understandable explanation of the basic principles underlying the strength of wing-beams, spars and other subjected parts.

DIMENSIONING and shaping of cross sections of an airplane member will depend on the magnitude, direction and relative position of the load. The member may be considered to be a small wire or the whole fuselage. All external loads must be in equilibrium with the internal forces (stresses) and the resulting maximum stress should not exceed the elastic limit, so as to prevent a permanent distortion.

The load may act vertical to the section, toward or away from it; it may act parallel with the section or rotative to the section; it may be placed close to the section or farther away. The simpler the condition the easier it is to determine the design of the section or to find the stresses in the section.

The simplest loading condition is when the member is in tension; then the resulting stresses are uniformly distributed over the whole area of the section. The load therefore will be equal to the area times the stress per unit area. If the load and the area of the section are given, the stress will be equal to the load divided by the area. (Sec. 1.) For example the load is 10,000 lbs. and the area 2 sq. in. The stress is 10,000/2 or 5,000 lb. per sq. in.

The tensile stress is independent of the length of the member unless the weight of the member must be considered.

This simple calculation may be applied to the calculation of stress in short members under compression or members under pure shear. Pure shear may be assumed possible if the units are close and the part to be sheared such as rivets, pins, rigidly held in place. Shear is usually accompanied by bending stresses.

Therefore the stresses in members under pure compression or pure shear will be equal to the load divided by the area. (Secs. 2 and 3.) Compression stresses are also known as bearing stresses. These simple stresses, tension, compression and shear, may all be present in one fitting, as indicated in Sec. 4.

Increasing the length of a member under compression will reduce the allowable load. The load will not be a function of the cross section area but will depend on the stability of the section; stability against sideways displacement. This stability is called the moment of inertia of the section. Sec. 5 shows the loads on a strut of varying lengths. The change-over from short strut to long strut and the additional influence of the wall thickness relative to the diameter, makes each section an individual case so that a single equation can not be formu-

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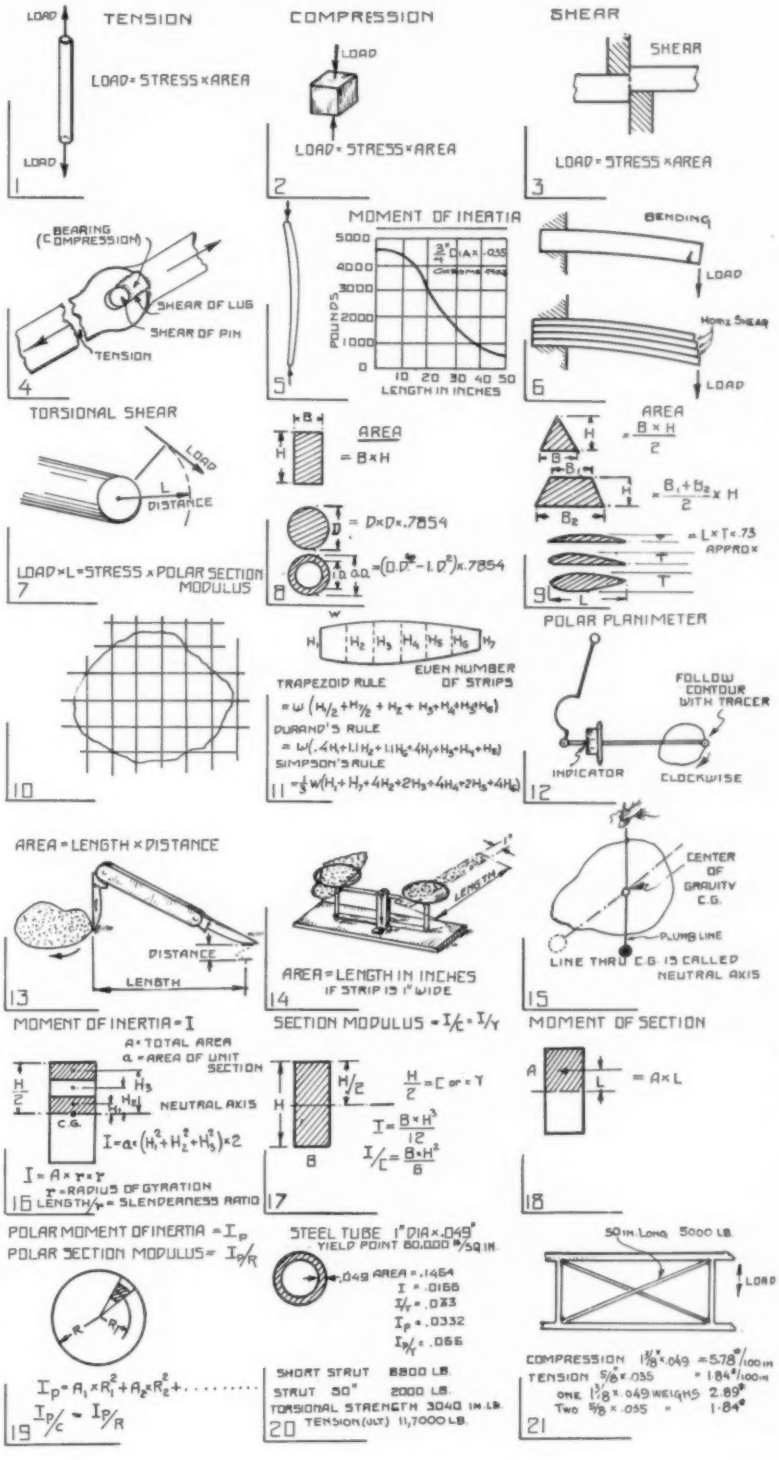

UNCLE SAM'S NEWEST EAGLE: the VOUGHT SB2U-1

LONG the rugged advocates of the biplane for naval operations, America's flying sailors have at last broken that streak with the placing recently of an order for 54 of these Vought SB2U-1 scout-bombers. Another "first" so far as these ships are concerned is the fact that they have been assigned to duty aboard the aircraft carriers. Carrier operations have served largely as the backbone for the Navy's age-old battle against the monoplane. With the purchase of these Voughts, however, the "feud" apparently ends. Powered with a 750 h.p. Twin Wasp Junior, the SB2U-1—as a dive-bomber—can be armed with either a 500 lb. or 1,000 lb. demolition bomb. Though no figures have been released on the ship, it is known that it also carries the standard complement of machine-guns. Sliding hatches cover both cockpits. Still another innovation for carrier operations is the ship's retractable undercarriage.

Build Art Chester's "Jeep" Racer

by

PAUL W. LINDBERG

Model Editor and Designer
for POPULAR AVIATION

Here is the sleek finished model of Art Chester's ship all ready to polish pylons.

SPEED, stability, plus a consistent performance are just a few of the wonderful qualities of this gas model. Its large amount of wing area permits it to come in for very slow landings. You will thrill at the appearance of this model in flight.

Being of a racing type we thought this model would be very tricky and fast on landings, but we found it to be just the opposite of this. The clean lines simplify the construction as well as add to the performance of this wonderful gas-powered model.

Construction of Fuselage

The main longerons are of basswood; all other pieces are of balsa. When the two sides have been constructed, the cross members are cemented into position. One-half inch No. 18 wire nails are driven through longerons into the upright and cross members of the fuselage.

From 1/8 inch sheet balsa cut the formers and cement them in their proper locations. Two 1/8x1/8 inch stringers are attached to the bottom of the formers. These are spaced evenly, as shown on the front view of the plan. The top of the fuselage is finished off with nine stringers which are attached to former F-3 and continue to rear of the fuselage.

The photo of the framework clearly shows the piece of body which is covered with cardboard and aluminum. One-eighth inch balsa ribs are attached to top of sides of fuselage (see side view of plan). After all cross pieces have been inserted in top of fuselage, 1/16 inch drilled dowels are cemented in and bound with heavy thread.

After the thin cardboard covering have been applied to the top of fuselage and the 1/8 inch ribs applied to formers 10 and 11, the cardboard fillets may be cemented in position. These are cemented to rib XX and fit snugly against fuselage. Use a little care in fitting these as appearance means a great deal at this point.

A 1/16 inch three ply veneer firewall is attached to front of fuselage. Drive nails through the veneer and into longerons and upright pieces so that it will hold fast. The motor mount is made from 3/63 inch half hard aluminum or 1/32 inch soft steel.

Construction of Landing Gear

The type of landing gear used on this model is simple to construct. It consists of two pieces of 1/8 inch spring tempered steel wire. The front piece forms the axles for the wheels and continues up into the fuselage. The rear wire is bound to the front wire and continues up and across the bottom of fuselage.

After the struts have been cemented between the landing gear wires, fill in bottom of strut where it connects with pants, with balsa. A little patience is required here as this will have to be fitted and shaped in order to obtain a finished effect. After this has been completed, cover complete strut with bamboo paper and shrink. The wheel pants are described on plan and are used for display purposes only. Do not fly model with wheel pants on.

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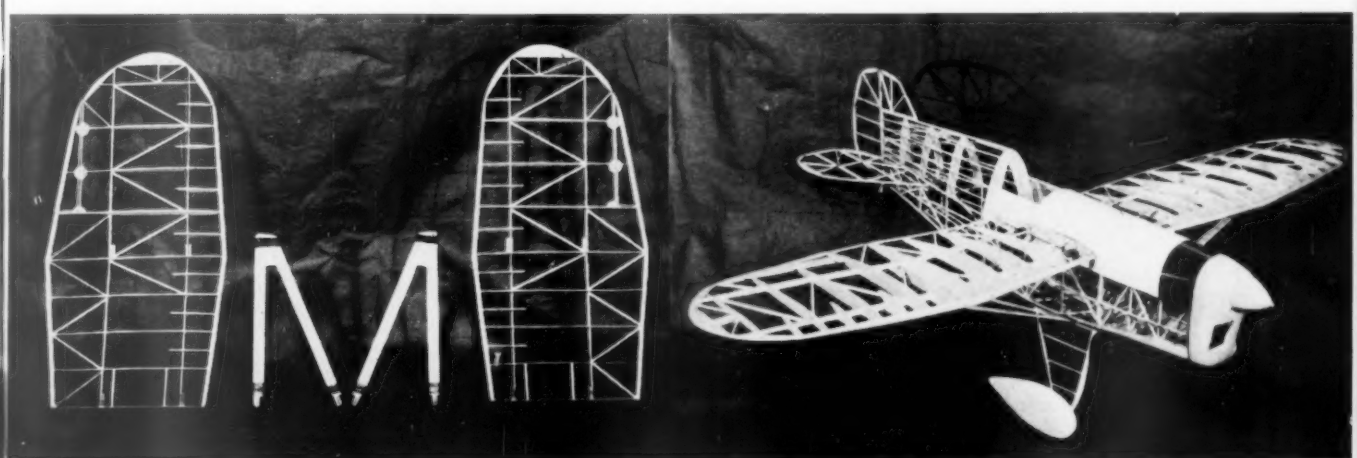

The assembly of the two wings (left) shows the characteristic buzzard wing of the speedy Chester racer. Note how sturdy, yet light, the entire framework of this ship is. At the right is the finished model—minus its attractive covering and streamline paint job.

The Art Chester Gas Model

(See Next Page for Details)

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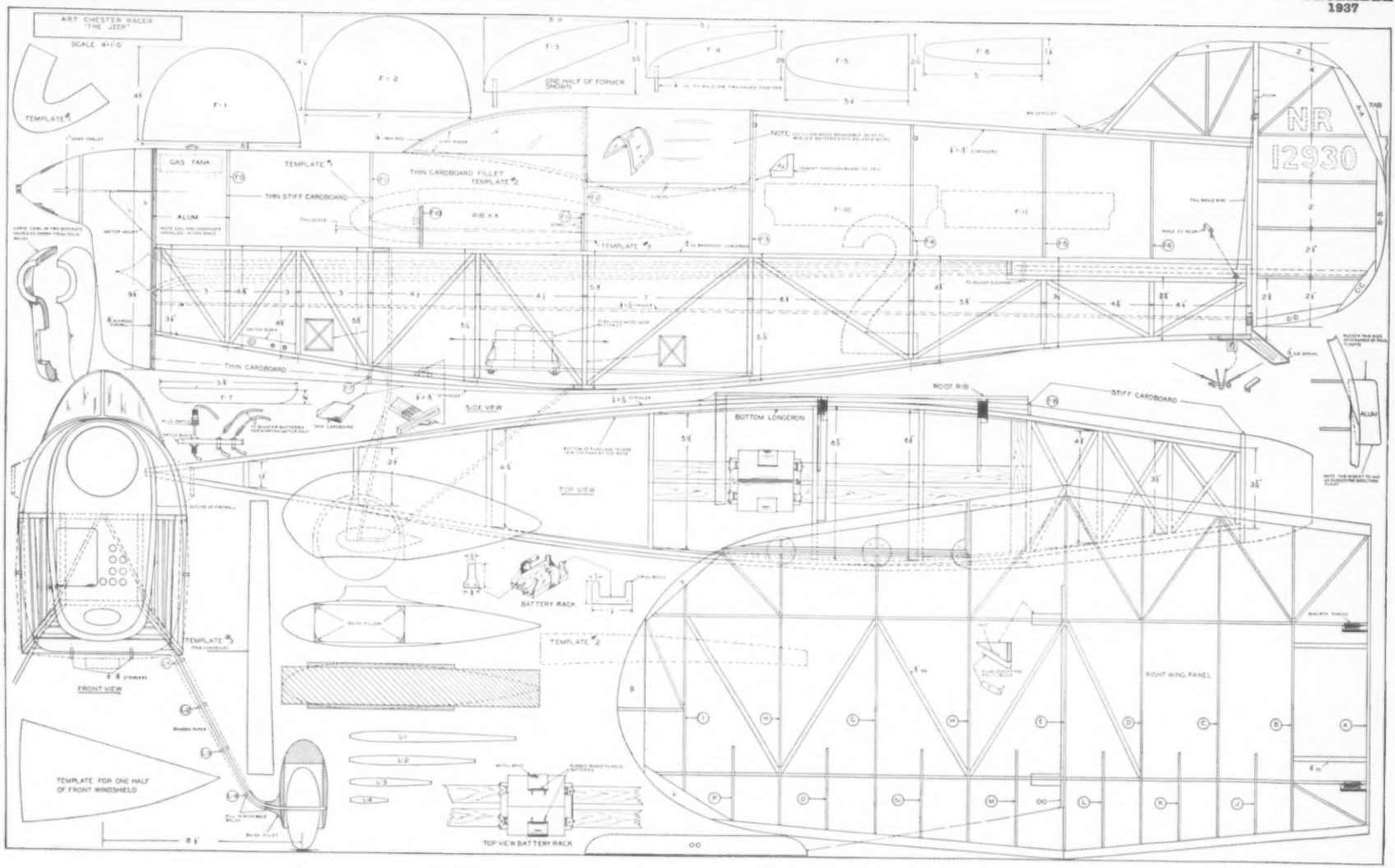

Plans for the Art Chester Gas Model

(*Continued from Page 65*)

Construction of Elevator and Rudder

The construction of the elevator and rudder is very simple as both are built to the front section, 3/16 of an inch in thickness. Construct upon a flat surface so that they will not have a tendency to warp. The elevator is adjustable by means of an adjustment screw located at the center of the leading edge. Lock nuts may be applied here after the proper setting is had. The rudder adjustment is very simple and is clearly explained in details found on the plans.

Construction of Wing Panels

All ribs are cut from 3/32 inch sheet balsa. Spars, leading and trailing edge then are cemented into place. Do not omit any of the bracing between the ribs, as this is necessary to strengthen them. Five-sixteenth inch dowels are cemented to spars at the root of wings. Bind these with thread or string. The wings carry moveable ailerons, which are a great help when flying the model, as a small amount of wash-in is necessary to counteract propeller torque.

The entire model is covered with a good grade of bamboo paper. In applying the paper to the framework, ordinary model airplane dope will not do.

Ordinary cement, thinned out slightly, makes excellent paper cement. In order to obtain a nice covering job, see that practically all wrinkles are removed.

Do not stretch the paper so tightly over the frame that it will have a tendency to pull it out of shape. After the various parts have been covered, dope with water. This will cause the paper to tighten over the framework. If the brush is used, extra precautions should be taken so as not to tear paper.

Any small spraying device is an excellent means of applying the water. After the pieces have become thoroughly dry, clear dope them. To obtain a smooth finish, a light sanding is given between each coat. To finish off the model, color coats are applied. Color used on this model is a very light cream and a very dark green trim.

It is best to keep the lacquer thin enough so that it will flow freely. This will require an extra coat but the results obtained are well worth the effort.

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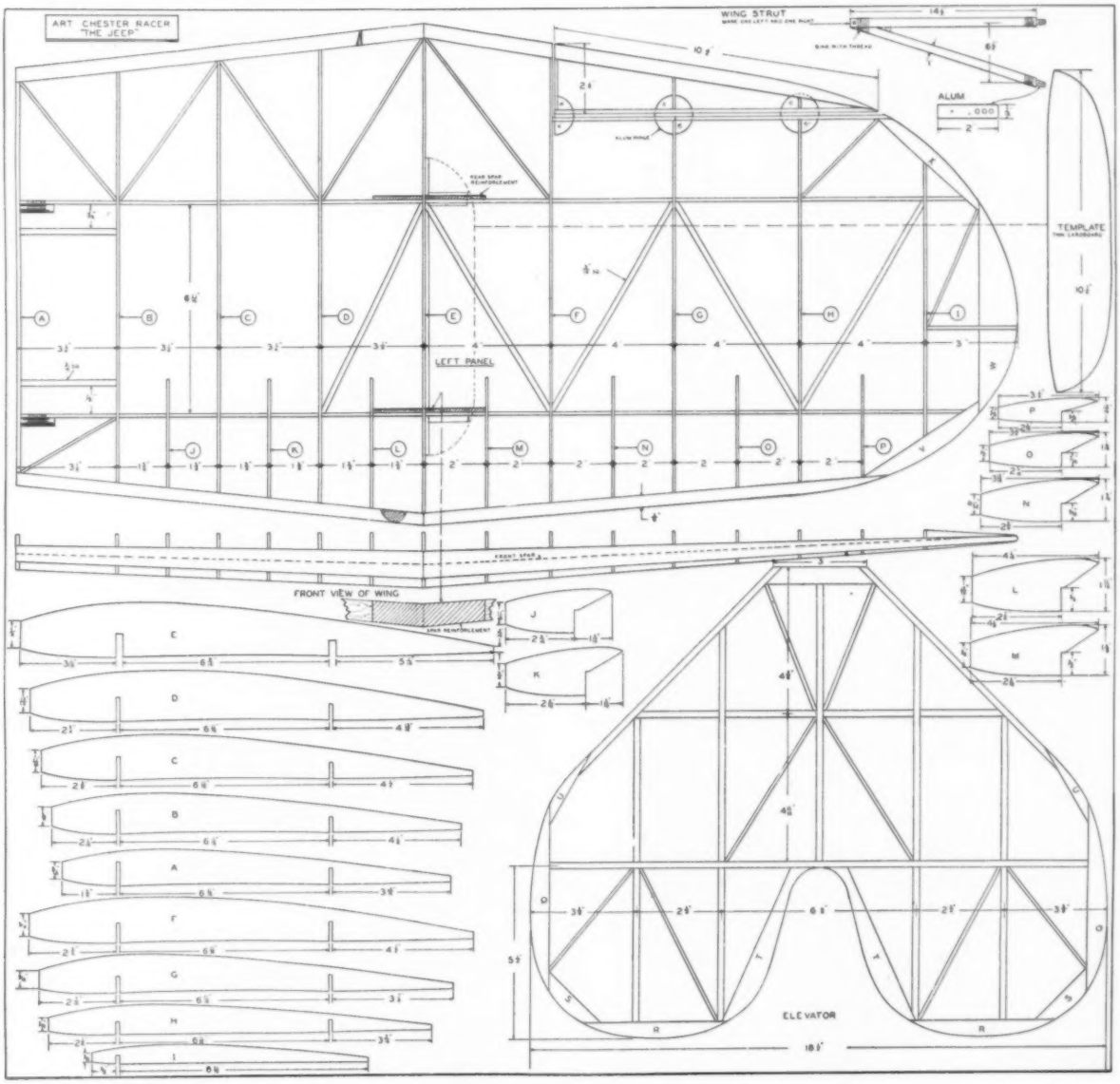

Strength Calculations

(*Continued from Page 63*)

lated. For this reason steel-tube manufacturers supply a whole booklet giving allowable load for each section of varying lengths and of various material.

Change of condition will result if a load parallel to the section is placed at a distance. The member then will have dditional bending stresses and horizontal shearing stresses, which surely complicate matters. (Sec. 6.) The resistance of the section against bending is called the section modulus and the function of the section for evaluating the horizontal shear is expressed in the moment of the section. The calculation of the horizontal shear must be investigated when the web of a beam is thin or the beam is of wood; for the sheer parallel with the grain is lower than the shear vertical to the grain.

The resistance of a member against torsional stresses will be a function of the section called polar section modulus. which is derived from the polar moment of inertia. (Sec. 7.)

It is shown that the function of the section of a member depends on the kind of load is applied. The simplest loading condition is when the stresses are uniformly distributed as under tension, pure compression and pure shear; then the area of the section will be considered.

Various methods may be employed in estimating the area of plan forms. Secs. 8 and 9 give formulas for areas of plane figures and streamline sections. Sec. 10 shows how the area may be found by counting squares. Sec. 11 shows how the area may be found by dividing it into an even number of strips of equal width and their ordinates used in one of the three formulas. The Simpson's rule is the most commonly used.

Instruments called planimeters are used in measuring areas. The load planimeter, shown in Sec. 12, is the least expensive. The principle governing the polar planimeter is easily understood if a pocketknife is used by holding the small blade lightly, tracing the contour of the section; then the distance times the movement of the large blade will be the approximate area of the section. (See Sec. 13.)

Nevertheless, a fairly accurate estimate of area may be made with an apothecary scale by placing the cardboard cut-out on one tray and a strip one inch wide on the other tray. Trimming the inch-strip or strips until the scale balances. The area of the cut-out will be equal to the length of the strip or strip in inches. (Sec. 14.)

To estimate the moment of inertia of a section the position of the neutral axis is required. The neutral axis is the lines drawn through the center of gravity of the section. This axis may be found mathematically or empirically; (Sec. 15) supporting the cardboard cut-out and drawing two plumb-lines, the intersection of the two lines will be the location of the c.g. The moment of inertia of an area with respect to an axis usually the neutral axis is the sum of the products of the unit areas and the square of their distances from the axis.

To simplify some of the calculations the moment of inertia can be expressed as being equal to the area of the section times the square of a distance called the radius of gyration. This radius of gyration and the free length of a strut has a certain meaning when estimating the allowable load on a strut. The slenderness ratio, the ratio of the length and the radius of gyration, will always give the same allowable stress assumed equally distributed. This is not the case if the wall thickness is to low. (Sec. 16.)

Dividing the moment of inertia by the distance farthest from the neutral axis the section modulus is found, which is used in figuring the stresses in simple beams. (Sec. 17.)

For estimating the horizontal shear the moment of all section must be known, which is the sum of the moments of all areas in reference to an axis as indicated in Sec. 18.

The polar moment of inertia of an area with respect to an axis vertical to the plane of the section is equal to the sum of the products of all small areas and the distance squared; this distance is measured from the axis usually running through the c.g. The polar section modulus is equal to the polar moment of inertia divided by the distance farthest from the axis (Sec. 19). For tubing the polar moment of inertia or the polar section modulus is twice of its regular functions.

Sec. 20 gives an example of the allowable load for a steel tubing. Sec. 21 gives an example showing that the use of two steel tubings will give a lighter structure than the use of only one tube.

It has been shown that the influence of the section on the allowable load varies with the material, length of the member, shape of the section and relative position of the load. It will also vary with the thickness of the material, with the radius of the curvature, and is influenced if other forces are present. This conglomeration of influencing factors was the result of making a whole series of working charts that give the load or stresses under any condition possible in an airplane member. They eliminate most of the old-time very-much empirical formulas that surely gave poor results.

END

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Landing-Gears

(*Continued from Page 61*)

tendency which is a product of the moment arm acting about the aerodynamic center of the fuselage and the force acting upon the vertical tail area.

The tendency to rotate is resisted by opposite aileron application and the reacting force applied to the rudder. The brakes are not effective at high rolling speeds and can only be applied gently and are not too effective in preventing turning in this instance.

The magnitude of the force acting upon the side area aft of the aerodynamic center is always large in contrast to the area lying ahead of the aerodynamic center. See Figure 1. Thus but feeble retarding forces are present to arrest a ground loop once it has started.

The position of the wheel center in conventional landing gears is somewhat of a compromise. If the wheels are located too far forward the takeoff characteristics are impaired. In this position, though, large braking forces could be applied without danger of noseover.

END

The Birdmen's Perch

Quite a few of you fellows who send in contributions to The Perch forget to put your street address on your letters, and we have the devil's own time getting in touch with you. We often want to make further inquiries, so do old "Tattered Wing Tips" a good turn and put your address down when you send along your stuff.

MAJOR AL WILLIAMS, alias "Tattered Wing-Tips," *Mgr., Aviation Dept.*, Gulf Aviation Products, Gulf Building, Pittsburgh, Pa.

THE HE-MAN OF DEATH VALLEY

Back in 1929 I was working at a California airport which had one of the oddest collection of aircraft antiques on the Pacific coast.

But one day there staggered in the prize of them all, a Tommy Morse One-Place Trainer of wartime vintage. It had a Le Rhone rotary engine.

Now, the pilot claimed he had 400 hours on the Le Rhone without a forced landing. I thought he was an awful liar, but a look inside the cowl showed that he was giving me the straight dope. It was lined with castor oil sludge half an inch thick and baked on hard.

The he-man who flew this jallopy that long, did so over *Death Valley!*

I mention this story because some of our modern he-man operators think they're doing well when they operate a modern engine 500 hours without grief.

I wonder how long the Le Rhone really would have functioned if it had had the expert attention of motor specialists and such good oil as Gulf puts out?

WILLIS L. NYE, Burlingame, Calif.

GAS DEALER WINS $14,400

Half the birds we know dream of winning a fortune on the Sweepstakes, but it took Rudy Kling, gas station operator from Lemont, Ill., to really clean-up.

Rudy, as you know, was the big surprise at the National Air Races. In a plane of his own design, he won the Thompson and Greve Trophy Races, and $14,400.

It is a pleasure to Gulf that Rudy used Gulf Aviation Gas and Gulfpride Oil in his plane.

HE MISSED THE HEARSE AGAIN

That newsreel cameraman whom the Cubans took pot shots at (see August Perch) must be the same one I know.

On that same Cuban trip "Al" told about, this guy heard that there's a big-shot rebel's funeral going on in another part of the island, so he rushed out to the Havana airport pronto.

Here he yells for somebody to fly him to the spot where the funeral is to be, and out runs a chap in uniform. He grabs the controls of the nearest ship and the cameraman climbs in with him.

The ship lurched drunkenly up the runway and finally nosed up into the air. After they get off the ground, the pilot explains that he's never flown a ship before, just ridden a few times. He's a rebel who wants to get out of Havana *toot sweet*.

The rebel and the cameraman (who'd done lots of flying, but no piloting) finally did get the ship landed at the right spot. But they were too early for the funeral. The Cuban in the ship was, believe it or don't believe it, the big-shot rebel who was supposed to be dead.

V. B., New York City

THIS MONTH'S WHOPPER

Dear Gents: Chuck Feldman had the biggest mouth in the world. Which is how come he got et by a grizzly bear. And the only reason that same bear ain't pickin' pieces of me out of his teeth is "Gulf Aviation Gas."

You see, we run out of gas in the mountains, and had to walk four-five mile to a fillin' station. All we had to tote gas in was my canteen.

The mountains hereabouts is full of small caves. We're half-way back to the car, with me clutchin' this canteen of Gulf, when out of a cave comes this bear.

Chuck, thinking real quick-like, squats down on his heels and opens that big mouth of his as wide as he can. The bear decides he's just another cave, and leaves Chuck squattin' there while he takes out after me.

He's gainin' on me, too, real steady an' annoyin', until I uncorks my canteen and takes a swig. When that Gulf hit my insides, I went about ten-twelve feet in the air and come down a-runnin'. I started across them hills, knockin' down trees an' tearin' up bushes somethin' scandalous. The Forestry Service is still writing me letters.

Well, gents, inside of three minutes, I'm passing Ponca City, fourteen miles away. After the effects of that Gulf wore off, it took me two and one-half days to walk back.

Sincerely yours, *Bill Gray*.

P.S. Oh, yes: I near forgot Chuck. He is still holding his mouth open when the bear gets back from chasing me. It worked swell, too; up until the bear decided that was the cave he wanted to live in.

Gulf Oil Corporation and Gulf Refining Company . . . makers of

GULF AVIATION PRODUCTS

The Story of the Amphibian

(*Continued from page* 14)

water, but they did not retract out of the air stream. The craft was powered with two 300 h.p. Wrights which were mounted above the wings in streamlined nacelles. A small wing joined these nacelles. This particular amphibian was a good performer and it was bought in quantity for the use of the U. S. Coast Guard.

About this time the Towle amphibian was produced. This craft was the first all-metal amphibian and it was also the first to ever be powered with Diesels. Although designed to be powered with two 225 h.p. Packard Diesel engines, the craft could be flown well on two Wright J-6 or two *Wasp, Jr.*, engines.

From 1931 to 1932 there was little original designing done in the amphibian field. In the latter part of 1933, however, Seversky brought out his first amphibian. This ship marked the first real step forward in true amphibian design since the days of the original Loening and Sikorsky amphibians. The machine was fitted with all-metal floats which were so arranged that they dropped down over the landing wheels as soon as the craft was in the air.

For a landing on water the floats were locked in this position. To alight on land the floats were unlocked and at the instant of contact with the ground they raised above the wheels. Thus, the wheels were at all times completely retracted within the floats unless the plane was actually on the ground. The wheels can also be raised or lowered by hydraulic means.

During the period from 1934 down to the present time there have been several original amphibian designs brought out.

In 1934, the Grumman JF amphibians, (JF-1 and the JF-2) were brought out. These craft are alike except for the fact that the JF-1 is powered with a 735 h.p. Pratt & Whitney *Wasp* and was delivered to the Navy, while the JF-2 is powered with a 750 h.p. Wright *Cyclone* and was built for the Coast Guard.

The JF amphibians are equal span biplanes of medium stagger and they are rather unique in that they embody a non-convertible fuselage structure which is continued integrally into a float. The fuselage proper and the float are joined by an enclosed compartment. The landing wheels of the craft retract completely into the sides of the float. Rated as a general utility ship, the JFs are giving good account of themselves in both the Navy and the Coast Guard.

This same year an amphibian was brought out by the Curtiss-Wright concern. This machine was designed by Capt. Frank Courtney and is powered with a 365 h.p. Wright *Whirlwind*. Mounted in a streamlined nacelle set well forward in the top biplane wing, the engine turns a pusher propeller through a short drive shaft. This results in the propeller being entirely free of the cabin while at the same time it provides for better docking facilities.

The landing wheels of this amphibian are set back of the center of the hull, while a nose-wheel is provided at the bow. This arrangement allows the craft to land and take off in exactly the same way from either land or water. The landing gear is designed to retract without hampering the cabin space. The nose-wheel retracts into a mast which in turn provides a handy mast for mooring the craft. With its 365 h.p. engine the machine has a high speed of 151 m.p.h.

One of the most interesting of the present-day amphibians is the twin-engine, 17-place Sikorsky S-43. Powered with two 750 h.p. *Hornets* it has a cruising speed of some 167 m.p.h. In the design of this craft Sikorsky followed the design of the S-42 *Clipper* boats and departed from his practice of using a short hull with tail surfaces mounted to the rear on outriggers. Instead, he employed a rather conventional flying boat type hull. Incidentally, the S-43 is the first Sikorsky amphibian on which the landing wheels retract completely out of the air stream. In the other models they simply fold up under the wings; in the S-43 they fit into the sides of the hull.

In 1935 another interesting amphibian, the Fairchild *Baby Clipper* was brought out. Designed for Pan American's South American river routes, this machine is the largest single-engined amphibian in the world. Designed by A. A. Gassner, it can carry two pilots, eight passengers, and 1,000 pounds of mail and luggage at a speed of 158 m.p.h. It is powered by a 650 h.p. P. & W. *Hornet*. The hull is of semi-monocoque construction and the landing wheels retract back, out and up into the wing roots, where they are completely out of the air stream.

One of the latest amphibians to be brought out is the *Sea Bird*, which is built by Fleetwings, Incorporated. This four-passenger job is fabricated entirely out of stainless steel and it is powered with the 285 h.p. air-cooled Jacobs engine. A high-wing monoplane type, it is rated with a cruising speed of 130 m.p.h. and a high speed of 150 m.p.h. The landing wheels of the *Sea Bird* fold laterally in streamlined casings and when in the "up" position they have the appearance of stubby wings. The wheels are at all times in view of the pilot.

That the amphibian has a very definite and important value in both a military and commercial sense, there is absolutely no doubt. A review of past developments in the field and a close study of present trends seems to indicate that although larger amphibians will be built in the not far distant future, there is but little new in the way of original design for some time to come.

END

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. . . THAT a Whirlwind-powered Curtiss-Wright Model 19-R Monoplane and three Whirlwind-powered Stinson Monoplanes will participate in a 20,000-mile good-will flight, touching every Republic in North and South America as well as the Dominion of Canada.

. . . THAT this flight, scheduled to start early in November, was organized by the Columbian Pan American Society for the purpose of establishing a Columbus Memorial Lighthouse commemorating the discovery of the New World.

. . . THAT this memorial, designed in the form of a huge, shining, white stone cross 1000 feet long, is planned to be both a tomb for Columbus and a lighthouse to guide ships and planes. It is planned to complete and dedicate the Memorial on October 12, 1942 —the 450th Anniversary of Columbus' great day.

. . . THAT this will be one of the most spectacular and far-reaching flights in the history of aviation on the American Continent. This 20,000 mile flight will parallel the historic flight around Latin America made by Colonel Charles A. Lindbergh in the Whirlwind-powered Ryan Monoplane in which he made the epochal non-stop, solo flight from New York to Paris on May 20-21, 1927.

. . . THAT in the brief span of 10 years since Colonel Lindbergh's famous flight in his Whirlwind-powered "Spirit of St. Louis", air transportation has had a phenomenal growth. Passenger traffic in the United States alone has increased from a few thousand airline passengers in 1927 to over a million in 1937.

. . . THAT Wright aircraft engines have played a vital part in the tremendous growth of air transportation throughout the world. Today Wright Cyclone and Whirlwind engines not only power the majority of the leading airlines of the United States, but the fastest airline equipment throughout the world.

"Fly with Wright the World Over"

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AERONAUTICAL CORPORATION
PATERSON NEW JERSEY
A DIVISION OF CURTISS-WRIGHT CORPORATION

Aviation's Future

(*Continued from Page 49*)

he confesses, the motive plant of his dream-plane must generate 200,000 h.p.—enough to propel the liner *Queen Mary*.

Every aeronautical engineer admits that larger, stronger and lighter engines are the stumbling block in the path of future aircraft development.

Today we see Boeing and Douglas approaching the halfway mark of an infant engineering industry that has already outstripped any other transport mode. We see Consolidated Aircraft Corporation at San Diego, for example, planning a Naval patrol boat weighing 110,000 lbs We see Glenn Martin, who produced the original *China Clipper*, offering to fashion a seaplane carrying 150 passengers.

Each company works on the principle voiced by Col. Edgar Gorrell, president of the Air Transport Association:

"We should be able to gain greater speed and greater range of operation from the same amount of fuel, yet double our present carrying capacity when we design future aircraft."

Tomorrow's vast air travel load cannot be handled in today's ships. And yet airlines cannot afford the risk of operating costly, clumsy, premature giants. That is why these engineers who prophesy the "flying wing" say—1950!

END

Air Board

(*Continued from Page 58*)

opment expenses are covered, whether they succeed or not in securing orders after the competition is held.

MR. CHRISTY, MODERATE PESSIMIST

But the pleasure of the Air Board at hearing these hopeful remarks was soon dashed by the more pessimistic outlook of the other expert, Mr. Christy.

Mr. Christy agreed that total sales for 1937 would amount to something like $115,000,000 but the profit margin would be only 7.8 percent. Some of the big manufacturing companies (the Big Eight) as they are sometimes called—Boeing, Douglas, Consolidated Curtiss-Wright, Lockheed, Glenn Martin, North American Aviation and United Aircraft) will do business ranging from $500,000 to $31,000,000 each this year, but profit margins will range around nine percent on such business. Nine percent sounds fine, but not all years will be equally good and such margins of profit do not permit of sufficient reserve for the leaner years which may lie ahead.

Then there is one terrible handicap under which the builders of military and naval aircraft suffer today, namely, the very long elapsed time between the design of a new type and the production order. For instance, Bell Aircraft received approval of their design in the fall of 1935.

This year, after a fine series of tests and surmounting of many troubles, they received a service or test order of 10 ships. It is only in three and a half or more years from the time when they started that this fine company will secure a real production order (if all goes well).

In the meantime they will have scarcely enough work to keep going, and their full overhead and plant expense will be going steadily on. All companies experience similar difficulties which not only make them lose a great deal of money, but also lessen the efficiency of our national defense.

For the airlines, Mr. Christy cited very unsatisfactory earnings figures. While some of the big transport companies are now doing an annual business of well over ten million dollars their earnings are less than 1 percent of the gross business.

END

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TAYLOR-YOUNG AIRPLANE CO.
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Automatic Pilot

(*Continued from Page 34*)

At this last station, the marker beacon impulse sets up another control that places the plane in the landing glide. As the wheels touch the ground, about 1,500 feet from the inner station, a switch on the landing gear is thrown by the impact. This switch it connected with the throttle, automatically shutting it down to idling speed, and with the brakes, applying them.

The plane used in initial tests is a semi-obsolete highwing cargo plane, characterized by low landing speed. Capt. Crane said the system will work equally well with fast-landing pursuit ships.

Perfection of the devices makes it possible, army officials say, to land a plane in dense fog, absolute darkness and other adverse conditions. It opens up a wide field of speculation on the future of aircraft—military and commercial—controlled by automatic devices.

This speculation is taking concrete form in the current tests at Muroc Dry Lake. "If planes can be landed entirely robot, why not take them off in the same manner?" asks Captain Crane.

The problem of taking off automatically is of secondary importance to robot landings, but it is the next obvious step in entirely unmanned flights. The same portable radio stations may be used for take-offs, and the same principle of altimeter-throttle control may be employed.

The only fly in the ointment is a very remote possibility of interference from some other station or nearby electrical equipment that might, by accident or design, cause serious difficulty.

It is not a rash thought that in the not-too-distant future a modern airport will be equipped with a portable guide line into the field, and another out of it, by means of which all airliners, at least, will be operated. Farewell, in that case, to the human pilot, for the crew of tomorrow may well consist only of a copilot and a hostess.

END

Swanee Taylor

(*Continued from Page 30*)

been "staged" as the climax of the acrobatic phase of the show. Billy Rose, for instance, understands dramatic values sufficiently to properly execute and arrange tempo and sequence so as to attain the ultimate in showmanship over promotion.

About the second point: It seems reasonable now that the Cleveland airport is so greatly enlarged that the races can be run up and down in front of the cash customers, using hairpin turns at both ends. This would lend thrilling visual effect and really be racing. Nor would commercial traffic be interfered with unless a gale were blowing across the field. But even so, the races are not long enough of duration to cause any hardship if an airliner or two had to stay out of the way 15 or 20 minutes.

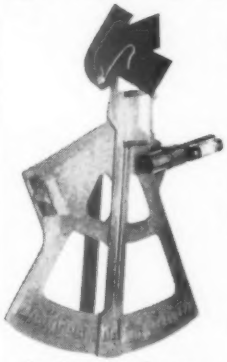
It was awfully nice to be back with you again after a year's unhappy absence, and we look forward to four more enjoyable Labor Day holidays in your midst. The general feeling is that Cleveland started this thing in a big way, and it is only just and proper that the races should forever belong to Cleveland. Yet it has been suggested that you gentlemen exercise a mite more supervision over the actual performance. You certainly know aviation well enough, and after having a chance to study the Great Lakes Exposition for two summers you no doubt are aware of the vital influence *tempo* and *sequence* exert on any public performance.

In conclusion, and for the sake of your fair city, let me say that it is up to you to see to it that no man can ever say that Cleveland, Ohio, refuses to bury a man who lost his life in order that a local enterprise might prosper. This is a holy responsibility which you cannot duck—nor would you want to duck it.

Supervise, gentlemen, supervise some. Please do.

END

From WALL St. to MAIN St...



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4. And on multi-engined aircraft, in the event of failure of one of the power plants, to secure maximum efficiency from the remaining power plants.

A large number of Curtiss Constant Speed Propellers are now in military service of the U. S. Army and the U. S. Navy.

"The Pioneers of Aviation"

CURTISS-WRIGHT CORPORATION
CURTISS AEROPLANE DIVISION
BUFFALO · NEW YORK

Patents

(*Continued from page 60*)

motors, passengers and cargo to conform with streamlining.

We are having our share of "futuristic" patents. Perhaps the most significant is No. 2,066,766 because of the inventor's name. He is Norman Bel Geddes, the noted American designer, architect, artist and author. Geddes is no mere visionary. He pioneered in developing the revolving stage, now a commonplace in big theater spectacles. He was a pioneer in streamlining automobiles, radios and other modern-day articles.

Geddes evidently got the idea for his revolving airport from the revolving stage. His invention is a blueprint of the "seaport of tomorrow"—a huge, rotating terminal for aircraft which would nestle at the harbor entrance to a congested metropolis like New York, which must depend now on land fields far removed from the center of city activity.

In Geddes' plans, the planes wing down and soar away from a platform which rotates so as always to face into the wind. An elaborate system of passageways built under this floating landing field lead passengers and cargo to and from shore.

Meanwhile, patent rights have been granted on an original type of plane invented by G. C. Lembras, of Chicago. The patent No. 2,067,770 applies specifically to his propeller. Instead of the ordinary, revolving fan type, Lembras' plane (see Fig. 3) gets its motivating power from a pair of gigantic screws mounted horizontally on top of the ship. Each screw is revolved at its rear by a motor, and tapers toward its front, which is held in a bearing. Air caught by the spiral, revolving vanes, says Lembras, is thrust backward, thereby giving the plane its forward impulse.

Patents were recently granted on several autogiro ideas. Patent No. 2,067,228, assigned to the Autogiro Company of America by the inventor, J. A. J. Bennett, details the construction of rotary wings claimed to be simpler and less expensive than predecessors.

Patent No. 2,067,633, granted to Raoul Hafner, of Vienna, Austria, details an improved method of connecting the blades of the rotating wing to its hub. Another, No. 2,068,616, granted to Edward Wilford, Merion, Pa., details how to take the plane's load off the rotating wing when the autogiro is in forward flight.

Among the other new patents are: No. 2,066,649, assigned by Rolland Sabins, St. Paul, Minn., to the Mechanical Development Co., St. Paul, a "shock-proof" wing in which the wing is governed by springs; No. 2,066,336, granted to Rupert Crouch and Harold Bolas, Pawtucket, R. I., a new-type wing slot; No. 2,067,516, assigned by William Webster to the Radio Corporation of America, a simplified radio direction finder.

END

P. A. READERS!!

of many years standing are the most fervent boosters of 'ole POPULAR AVIATION. Through its pages they have followed the progress of aviation, year by year, and endorse its policies and objectives.

You, too, will find it a most useful and interesting companion, no matter what your aviation interests may be. Subscribe today in order that your file will be unbroken.

POPULAR AVIATION
608 S. Dearborn St., Chicago, Ill.

Cadets

(*Continued from page 20*)

day afternoon. The plane was equipped with a radio and a radio *beam!*"

Today one of our misters had a story to tell about his cross-country trip this morning to Brady and San Angelo. It seems that he was flying with his cockpit cover open, his map in one hand and the stick in the other. The wind caught the map and tore it off clean just above San Angelo. Thinking he was lost, he "buzzed" a town (flying low over it and reading the name of the railroad station), and then he couldn't find the town on his map. Finally he turned and flew south until he picked up a town that was on his map and came on in to San Angelo.

But not everyone gets lost. Usually if you will depend on the compass and keep an accurate check of time against distance the check points will show up.

This evening I can hear the night flyers out roaring around. We have had three phases of this very interesting work. The first was merely to become accustomed to the plane and land by the use of the field floodlights. Our tendency here was to land on top of the beam—some eight or nine feet in the air. Occasionally somebody would drop a wing and get a wing tip. But the Nine is a sturdy ship and can take it.

Then in our second phase we landed with our wing-tip lights on the dark field. Here the tendency is to fly into the ground. The instructors in the control tower have a clear unobstructed view of the field and could tell exactly how the plane was coming in. Then we would hear something like this coming through the headphones:

"Pull that nose up. Not too far. Easy. Easy. Okay. Now set her down." The boys call this "landing by candle-light."

The third phase was to circle the field at 2,000 feet, drop a flare and land. The flares burn 2½ minutes and tend to oscillate if there is any wind. Coming in on the last leg at 500 feet you would first see a brilliant patch of light, then a dark spot as the flare swung back and forth. The trick was to land in the lighted area.

Next Thursday night our flight starts the 4th phase, N-9-S or night cross-country work, first on short flights, then on longer hops when we make a day flight to some point, wait until dark to hop off to Randolph.

Flying here at Randolph is fascinating business. There is nothing dull about getting into a ship, climbing high and watching the rivers and lakes and green fields.

END

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Canadian Airport

(*Continued from Page* 16)

nearly half was flown to the 10,000 mining inhabitants of Patricia district in Northwestern Ontario. At least 6,000,000 pounds were landed at Red Lake while, in addition, many thousands of passengers were taken in, together with several hundred thousand pounds of mail.

Red Lake, definitely, is the largest most isolated town in the world. One hundred miles by plane from the closest railway, this town, and surrounding area, depends entirely upon aircraft and radio for rapid communication. The finest radio-telephone-telegraph service in the world is now being installed to connect this town with "outside."

It is a far cry from 1925 when prospectors, rushing to Red Lake when the gold call came out, set from Winnipeg prepared for a long difficult journey through bush and muskeg—a trip which took at least a week. It was necessary to travel all night by train for 250 miles until the "jumping-off" point to the north could be reached, before the trip could even start on foot or by canoe. Now a plane sets out from Winnipeg and travels in a bee line, cutting down the total distance from 450 to 200 miles, while the time is reduced from a week to the matter of two hours.

Pickle Lake, 350 miles by plane east of Winnipeg, receives the Winnipeg morning paper at noon by plane, while the same paper is not delivered in Kenora, 130 miles by train from the Manitoba city, until four hours later.

The most varied collection of planes in Canada call at Red Lake in a day. There is the largest single motor ship in the world, the model Ju-52 Junkers 2½ ton freighter; the largest passenger machine in Canada, the Lockheed *Electra*, Travel Air, Fokker, Fairchild, Noorduyn *Norseman*, Bellanca and DeHavilland freighters; Waco, Moth and Stinson passenger machines; also the fastest plane in Canada on floats, the new low-wing twin-engine Beechcraft.

Planes in Red Lake perform combined duties which, ordinarily, trains, taxis and street cars are called upon to perform in a "civilization" city. Here is a typical day's work for one pilot. First the craft will come in 200 miles from Winnipeg, carrying a heavy load of machinery, possibly a portion of a tractor or half of a Diesel engine. Going out to Sioux Lookout empty, the ship will return with a load of 10 passengers and, in addition, baggage and a few pounds of express. The third time, the same machine comes from Kenora and lands in Red Lake, carrying a full load of 2,200 pounds of mail. Before the day is over, the same transport still has time to do a little taxi or street car work, by the way of "jitney" hops between Red Lake town and the outlying settlements which surround the various mining operations that are spread out for 25 miles to the west of the town, 15 miles south and west, and 10 miles north and east. The machine may load up with requirements for half a dozen different points.

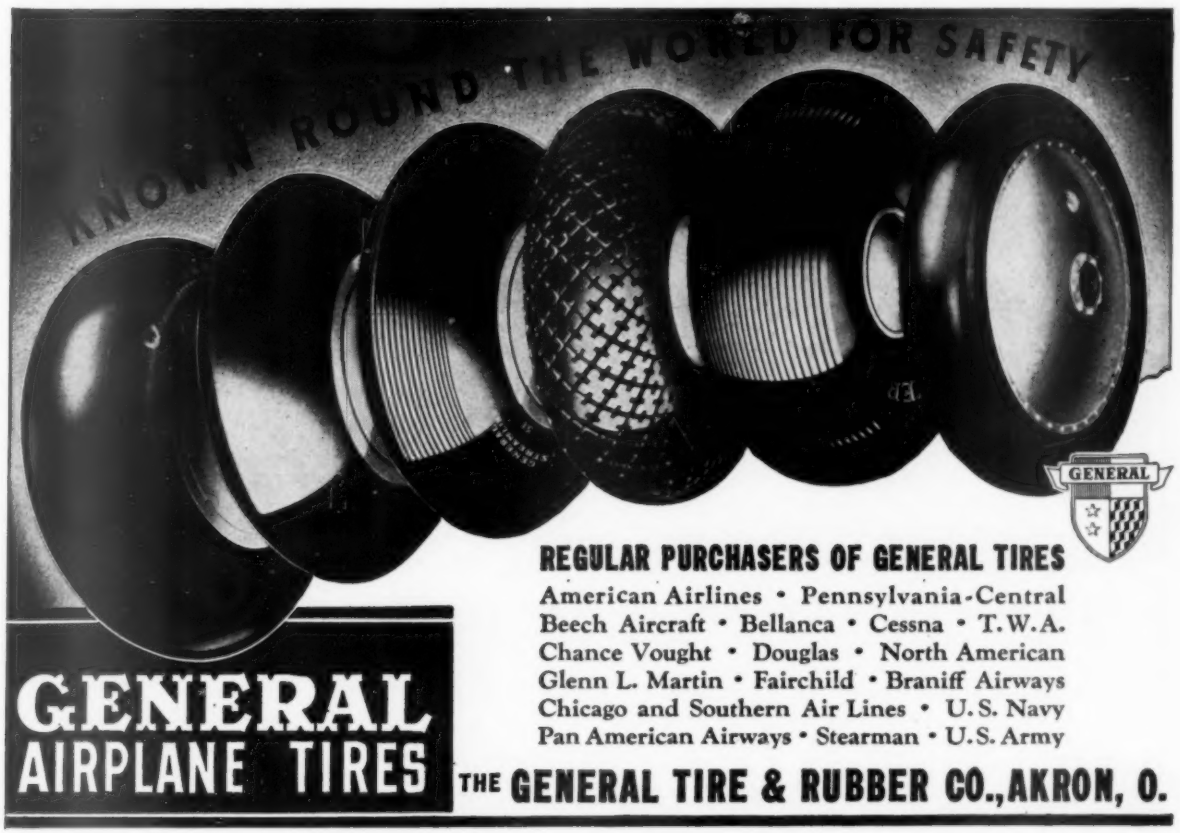
It will stop, first, at Altura Gold Mines, four miles from the town, and leave a passenger. Next stop is Monetary Metals where three bags of potatoes are dropped off while, upon arrival at the Big Lode mine, a few pounds of mail are left, together with a passenger. When Cole Gold Mines is reached, 25 miles from the town, two bags of mail and three dozen eggs are delivered.

Then the plane heads southeast to Medicine Stone Lake, 14 miles southwest of Red Lake town, where a crew of prospectors receive a box of groceries and, in turn, give the pilot a letter ordering further supplies to be brought in on the next trip. The day's work is finished after stopping at McKenzie mine, five miles north of the town, to pick up two passengers and a gold brick to take into town for the night.

A plane serving Red Lake is a freight train, passenger train, street car, automobile and boat all in one. Whether it be a dozen of eggs, a complete mining town, a doctor or a mining executive, it is all the same to the northern Canadian air companies. They all go into the same fuselage.

And the peculiar part of it all is that Howey Gold Mines (premier of Red Lake producing gold mines) the second lowest grade gold mine in the world, was brought to its present state of efficiency through aid of the airplane, in spite of low grade of the company's ore-body.

END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Aviation, Blondes and Lingerie

(*Continued from Page* 58)

make a 2,000-foot free fall with the Russell pack, and around four o'clock we took up a collection, took off a door of the *Robin's* cabin, and took off for position 3,000 feet above the field. Romeo sat in the front seat, piloting; Squatting Heifer sat beside me in the back seat; and I, weighted down with a 28-foot back pack and a 24-foot chest pack, sat beside the open door. I was in a hell of a humped-over, uncomfortable position with those chutes on me, and kept squirming around all the way up.

And somehow those dainty pink things, now slightly soiled from polishing the ship, had half worked out of my pocket—though I didn't know it at the time.

Anyway, Romeo climbed her to 3,000, cut the motor over the field, and with Squatting Heifer shoving from behind I did a forward somersault out of the cabin.

Then the wind began to scream in my ears and the ground started rushing up to meet me at terrific speed. I had straightened out full length in the air, had stopped somersaulting, and was now plummeting earthward head down—lying rigid as a log with the fingers of my left hand clenched in the rip-cord ring on my left hip. When the cars on the ground began to loom up bigger and bigger I yanked hard on the ring. The pack on my back opened with the speed of lightning.

Many times I've waxed a bit sentimental over the old 34-foot homemade chutes I used to jump, because they never failed, and let a bloke down pretty easy. A few minutes later I was wishing I had had one, for it was hot and the air was thin and the field was nearly 3,000 feet above sea level. When I landed not far from the cars I hit the ground so hard that a muscle in my left shin jumped up over another and formed a huge lump.

Great jumping horned toads! How that leg did hurt! I managed to get up, tried to take a step, and the muscle snapped back again with a crack you could have heard a hundred feet away. I gave a yell of pain and promptly sat down.

I was still sitting there rubbing my leg and cussing a blue streak a few moments later when the crowd piled around to ask fool questions. Romeo landed the ship and accompanied by Squatting Heifer came strolling over.

And then my leg—the pain—the chutes—everything was forgotten as trouble of a new kind lit on my innocent head. A small boy, red of face from running, and very excited, pushed his way into the circle with something in his hands.

"Mister," he panted, "I saw something fall out of your pocket and ran picked it up while you were landing. I thought it was your handkerchief, but I reckon it ain't," and he spread 'em out for me to see.

No, gentlemen, it was *not* my nose blower. I wish to high heaven it had been! It was those blamed pink undies with the fancy fringed edges that Squatting Heifer had pilfered from the maid.

There were a dozen women standing around and they got sort of red in the face and began to titter. I got sort of red in the face but I didn't titter. Somebody snickered out loud. Squatting Heifer went into spasms. Everybody began to grin at me with that "Naughty, Naughty!" look on his and her faces.

All except Romeo, who was still half peeved because I'd turned down the date he'd made for me. As though the *kid* hadn't done enough, Clark Gable had to do *his* Boy Scout act.

"So you had to go see a man about a parachute, hey?" he cracked, his voice dripping with unconcealed sarcasm. "You ain't satisfied with the date I make for you but you has to go off on your lonesome. All right for you, you double-crosser! But your whiskers will be clear down to your knees before I do you another favor. Parachute! Phooey—what a liar!"

I repeat it, gentlemen, I do not believe in circumstantial evidence!

END

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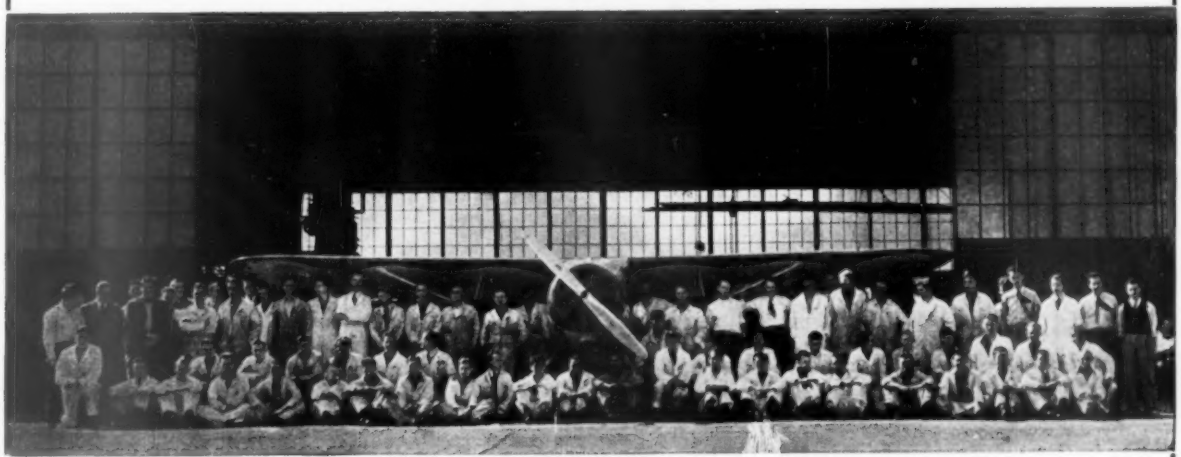

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Airy Chat

(*Continued from Page 8*)

the-walk as a military craft because of its greater speed, lower cost and greater maneuverability.

The all-metal airship built several years ago, proved most satisfactory and reliable under all sorts of conditions and we hope that the new ship or ships will be constructed along lines that have proved feasible, safe and sound. We are not believers in airships but if we must have airships, let them be of the same general type as the ZMC-2.

* * *

IN regard to the rulings of the Bureau of Air Commerce on student qualifications, it sometimes suggests to me that the Department is working hand in hand with the Army and Navy, for the physical examinations for private and commercial pilots are nearly as rigorous as those drawn up for our military flyers.

It is getting to a point where one needs to be a sort of superman, physically, before being allowed to perform that simplest of routine operations—fly a ship. Perhaps the government officials have in mind a host of military pilots gathered from the civilian pilots who are trained—at their own expense. This seems hardly fair in view of the many European nations who ease down the burden of training expense upon their private and commercial pilots because of possible future service in their military air-forces.

* * *

IT is to be hoped that, in the immediate future, that the average normal person be allowed to fly without the present extravagant demands for physical perfection. If a man is physically competent to drive a car on public highways and in city traffic, his physical and mental equipment should be fully adequate to cope with the problems of flight. Anyone who can navigate a car on Sunday through the throngs of cars on the highways should certainly be able to navigate an airplane through the open reaches of the atmosphere.

* * *

CHICAGO'S plan for a Lake Front airport has turned over another cog which, in view of the hazards involved, will place it on a parity with other large city airports. Organized societies have been combatting this menace for several years, but it looks as if politics will finally put the project over in a big way with a correspondingly big expenditures of money.

Located in the windiest part of the city with the normal take-off over the highest Loop skyscrapers and a ten mile flight over turbulent city air, the pilots of the airliners will have plenty to do to keep their minds off tennis or polo. And then the heavy lake fogs come rolling in, frequently with zero visibility, just to make matters interesting.

The only thing lacking in the picture is a couple of pole-lines filled with high tension wires, but those will undoubtedly be supplied as soon as the project becomes more fully organized.

* * *

ONE by one, visitors tell us that the greatest feature of the Cleveland air races was the unusually well attended meeting of the Early Birds at the show. It was a real get-together of all the pioneers who made aviation a possibility and who still have a great affection for the game although they are no longer actively engaged in it. Once an aviation fan always an aviation fan.

* * *

AND once more I sing the praises of the metallurgists who are largely responsible for our present progress in automotive engineering. The last report from this group of industrious workers is the development of a new aluminum alloy weighing slightly less than dural but with a 50-percent. greater tensile strength and complete immunity from the destructive attacks of salt water. This is a Belgian development labeled Imopa.

* * *

AND, by the way, I have broken all of our age long traditions in this Airy Chat by not referring to Christmas and Santa Claus in the opening paragraph. I beg your pardon—and wish you the same and many of them.

* * *

WHILE radio has worked many miracles, yet it has been my experience that it is not to be depended upon implicitly.

END

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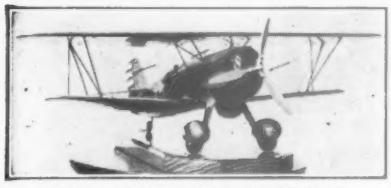

Photograph of the Curtiss Hawk P-6-E Model

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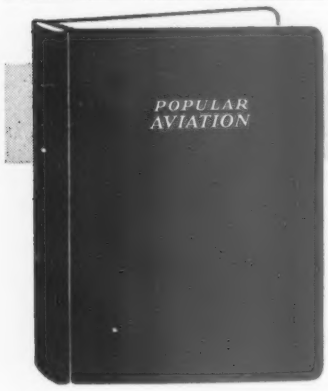

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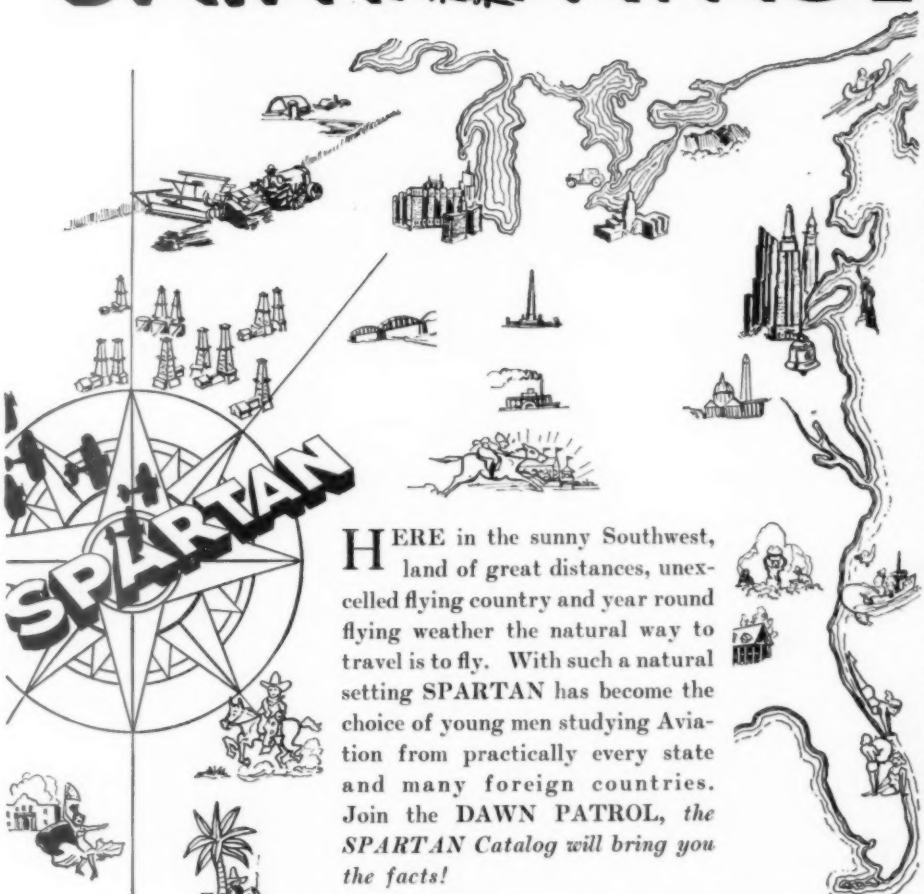

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This Gas Model Ban

(*Continued from Page* 50)

all phases of model plane competition. At Detroit these B. A. C. officials saw hundreds of gas jobs competing without an accident of any sort.

Many of the flyers who competed in the gas events were from 18 to 30 years in age. Restrictions imposed by the National Aeronautic Association prevent those under 16 from competing, but some of the contestants were over the 30 mark. Dentists, lawyers, mechanics, men and women from all walks of life were among the 200 in Detroit to fly their gas jobs.

It is the same everywhere, especially in the ranks of the B. G. M. S. The average gas model builder is over 21, keenly interested in aeronautics through his participation in gas model flying, and anxious to fly his or her ship in a manner to keep it intact.

Mr. Goodwin's office tells us that you are the gentleman to whom we should address protests on the recent state ban on flying gas jobs unless we hold pilot's ratings. As an interested official of model meets and as an aviation leader, the officers of the Boston Gas Model Society feel that you will give our appeal close attention.

There is an outstanding point in the argument that gas model flying should be encouraged. That young men and women who previously had no more than a cursory interest in aviation can out-design and out-build and out-adjust commercial designers is an amazing thing, indeed. Gas models are more stable, more efficient than any man-carrying plane flying today.

There have been certain alarmists, who, for their own reasons, which are rather obvious, have raised a great cry in the sensational press of the country of the purported dangers of gas model flying. Storage of gas in the homes and sending gas models aloft with full gas tanks for half-hour flights have been cited as arguments for the banning of gas models.

An eye-dropper full of gas, the amount required for a gas model's flight, is infinitesimal in comparison with the gallons of gas to be found in any garaged auto. Such small amounts of gasoline as may be found in a modeler's possession are nothing compared to the explosive cleaning fluids stored by many a housewife.

Gas modelers no longer fill up their gas tanks for cross-country flights. With the growth of the hobby, and the influence of adult leaders, competition has changed from straight endurance flying to precision events.

It is understood that one of the reasons state aviation officials welcomed gas models so enthusiastically is that when some young man writes to his local inspector "Sir, you are stifling the progress of aviation when you won't permit me to build a home-made plane with an engine from my 1921 Ford" the inspector will be able to reply:

"If you are really interested in aviation and in building a plane, let's see you construct a gas model. Now there's a task for you—build and fly a small plane powered with a 1/5 horsepower engine and you'll really be doing something. Work out your ideas of design to small scale and you will gain all the results you want."

Radio-controlled gas models are becoming more practical with several such craft competing this year in Detroit. Of course, the cost of such models would not permit every builder to fly one, but the possibilities of such craft in both peace-time and war are tremendous.

The Boston Gas Model Society is about to inaugurate a new series of contests for its members, and will do so as soon as the ban on flying gas models in Massachusetts is lifted. This new type of contest will be for spot landings, precision events for take-off and landing, and special trials for the best designed, constructed, finished and performing gas models.

According to press reports Mr. Goodwin banned gas models on the grounds that they were aircraft, and insisted that they cannot be flown in this state unless licensed and operated by licensed pilots.

END

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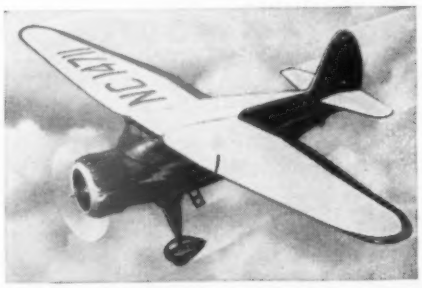

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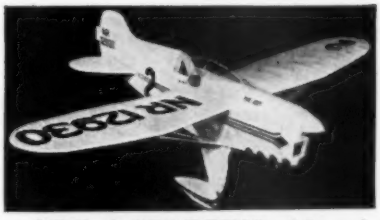

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Lufbery

(*Continued from Page 20*)

1885. His father emigrated to America in 1891.

Even as a youth Raoul evinced his desire to see the world and in 1904 set out, eager to see the other side of the hill. In 1908 he enlisted in the American Army, seeing service in the Philippines and remaining in the Far East after his enlistment expired.

In 1912 while at Calcutta he met Marc Pourpe, a French aviator, and joined him as his mechanic during exhibition flights through Asia and Europe. At the outbreak of the war they enlisted. Pourpe was killed in December, 1914, and Lufbery fought to avenge him.

He first flew in bombardment squadrons but on May 24, 1916, he transferred to pursuit flying in the Lafayette Esquadrille. After the United States entered the conflict Lufbery was commissioned a major and assigned to the 94th and 95th Pursuit Squadrons, then operating in the Champagne sector. There he taught the men combat tactics but was unable to engage in active fighting because guns and adequate equipment were slow in delivery.

In April, 1918, the guns arrived. Lufbery installed them in the Nieuport planes which by that date were outmoded, and led patrols over the enemy lines and followed his old custom of lone fighting.

On May 19 a German photographic plane flew over the line. Lufbery jumped into his ship and started in pursuit. In his first attack staged at about 2,000 feet he fired several short bursts then swerved away as though his gun had jammed. Having evidently cleared the fault he again attacked. Suddenly a puff of smoke came from his plane, then a burst of fire. Like a flaming torch it proceeded on its way for a short distance, then winged over.

As it neared a small stream, Lufbery jumped, evidently with hope of saving his life, but instead his body landed in the garden of a little house. What a great pity that he had no parachute.

The Germans had developed 'chutes for their flyers, and the life-saving canopies were common with balloon observers, but the Allies had not issued them to their pilots. The stark realization that Lufbery's life would undoubtedly have been saved if he had worn a 'chute, forced inventors to hasten their efforts to provide a suitable life saver for airmen; Lufbery's unwarranted death became an inspiration for the saving of other lives under such circumstances.

Major Lufbery was officially accredited with 17 victories although it is more than probable that he achieved as many more so far in German territory that they were not accredited.

The compass was removed from the wreck by Dr. F. Cautin and given by him to Dr. P. W. Place who, as he wrote in his letter of transmittal to the museum, realized that it was after all Government property, and turned it over to the museum.

END

Symposium

(*Continued from Page 62*)

summarizes the roof-top flying situation in such admirable fashion that extensive quotation is in order:

"As regards the actual experiments with autogiros for pick-up of mail from post office roofs, I think it is absolutely essential that we do not lose sight of the potential hazard to our city dwellers as soon as heavier than air craft of any type are permitted to fly at low altitudes over metropolitan areas. Though the autogiro's remarkable safety record and performance characteristics singles it as the logical machine to carry out this very useful function of shuttling mail from the airport to the post office roof, and though our modern aircraft engine performance as regards reliability is a record which we may all be well proud of, the fact of the matter remains that even the best aircraft engines do falter or stop on occasions and the only fatal accident experienced in an autogiro in this country presents the example of a faltering motor and a slowly descending autogiro, which came to grief when the whirling blades encountered telegraph poles and guy wires which catapulted the machine to the highway directly below and, fortunately, there was no actual traffic at the moment. However, in this accident we have all of the potentialities of hazard to pedestrians and all others in the city who become exposed when low altitude flying becomes a reality. These considerations caused the municipal authorities at London, England, to withhold any further experimentation of roof top operations with their post office until such time as twin-engined autogiros became available. In my opinion, this was not a satisfactory conclusion because twin-engined autogiros do not seem to offer an all-time solution for this problem, particularly since switching from the balance thrust of two engines to one in case of side engine installations is not as simple in the autogiro range of flight characteristics as it is in the airplane. In conclusion, I would state further that it appears useless to pursue this very promising operation until such time as direct take-off becomes a reality. With such operations in mind we are bending our every effort to the early completion of a thoroughly practical direct take-off machine since we have demonstrated to our own satisfaction a mechanical means of accomplishing it and we trust that we may be in a position early in the spring of next year to offer a small machine

(*Concluded on Page 86*)

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Rotor Aircraft Symposium

(*Continued from Page* 84)

which can satisfactorily execute this important maneuver."

The Conception of the Vertaplane

It was most fitting that Gerard P. Herrick should a few weeks after the highly successful flight of his "Vertaplane" make a statement as to the purposes and fundamental conceptions of his machine. Mr. Herrick, a born raconteur, preceded his remarks with a charming story about Lindbergh who, when under the tutelage of his cousin, Ambassador Herrick, was called upon to make a speech in Paris soon after his successful flight.

Mr. Herrick's conception of the "Vertaplane," arose from the following reflections. There is no doubt that the airplane is now and is likely to remain the most efficient and therefore the speediest embodiment of heavier-than-air flight. On the other hand the rotor provides the safest landing, almost vertical descent and in general has many advantages unrealizable by fixed wing aircraft. Why not combine the two types, with a fixed wing for high speed flight, convertible into a rotor for descent in either normal or emergency operations?

Through ten years of experimentation, meeting difficulties of every description courageously. Mr. Herrick stuck to this conception, and has been amply rewarded by highly successful test flights in Philadelphia a few weeks back.

The conversion of the fixed wing into the rotor was only made possible by the careful development of an airfoil symmetrical fore and aft, of generally elliptical form, but of course with more camber above than below. The Herrick airfoil has an efficiency which is only a trifle lower than that of the conventional airfoil of founded bow and sharp trailing edge. The development of this airfoil, was accompanied by careful experimental work in the wind tunnel of the Daniel Guggenheim School of Aeronautics at New York University. With the airfoil symmetrical fore and aft, there was combined a single horizontal hinge placed immediately above the vertical axis of rotation.

If our readers follow this basic principle and look at the accompanying sketch, they will readily understand the other characteristics of the design. Normally the cellule is a biplane, with the upper wing considerably larger in area than the lower wing and the ailerons placed on the lower wing. Fuselage, engine mount, elevators and rudder are all of normal characteristics. For ordinary flying the upper wing is held rigid. When aloft, the rotor held in place by two struts is released from its mounting, and a starter puts it into rapid rotation. The inequalities in rolling moments are taken up by carefully designed shock absorbers and once the rotor has achieved autorotation, the aircraft continues to fly just like an autogiro or a gyroplane.

While definite performance figures are not available, the tests have definitely established that the "Vertaplane" with fixed wing is an efficient airplane. That it can take off and fly as an airplane or as a rotor plane; and that it can readily be converted in flight from the airplane to a rotor plane, with all the advantages inherent in a rotary type machine for landing in restricted territory or under conditions of emergency.

As Mr. Herrick put it, "We don't know where we are going but we are on our way," and while no one can yet predict the commercial possibilities of the "Vertaplane," it is undoubtedly a valuable and desirable addition to the art, on which Mr. Herrick deserves the heartiest congratulations.

Gyroplane Not Autogiro

With Webster's dictionary as his authority, Mr. Wilford pointed out that the correct designation of rotary wing aircraft was "Gyroplane" and not autogiro and that autogiro should be regarded as really only a trade name. Mr. Kellett on the other hand was of the opinion that the name autogiro had become a generic term. We leave to philologists further discussion of this interesting point.

Program In The Wilford Gyroplane

It may not be out of place before presenting Mr. Wilford's interesting remarks to review the differences that exist between the three rotors, Cierva, Herrick and Wilford, as illustrated by our sketch. In each of the three there is a substantially vertical axis of rotation, no application of power, and the phenomenon of autorotation. But in the Cierva rotor, each blade is hinged about a horizontal pin and is free to flap up and down. In the Herrick rotor the blade flaps but about a single, central horizontal hinge. In Wilford's rotor the blade feathers about an axis which is substantially parallel with the span of the blade. The aerodynamic results achieved are very similar in all three rotors, even though the means employed are different, and though the structural problems are of a different character in each. It is not proposed to discuss the relative merits of these three rotors, but there is not the slightest doubt that each has its sphere and that each merits the utmost in further development. Moreover we believe it is for the good of the rotary aircraft art that several competing principles should be actively pursued.

(*To be continued*)

What Plane Is That?

(*See Page* 14.)

1. Bellanca XSE-1.
2. Stearman (for Colombia).
3. Handley Page "Harrow".
4. Curtiss P-36.

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P-12

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I Fly the Pacific to Hongkong

(*Continued from Page 24*)

month. Curiously, *Clipper* passengers feel the same way about flying boats after crossing the Pacific in five brief days—a distance it takes steamers a month to span. The reason for this is that the combined area of the *Clipper*, while huge for a flying boat, is so much smaller and more intimate than a surface ship.

Passengers become as closely attached to a *Clipper* in five days as those who ride a steamer do in 30 days. What is more remarkable, with one exception air travelers flying to China sleep ashore each night entirely away from their *Clipper*, coming back each morning for the daytime flight. At night they rest comfortably in modern hotels at Honolulu, Midway, Wake and Guam while their *Clipper* idles quietly in the nearby ocean.

Travel by air across the Pacific has already become a routine means of transportation. One of the *Clipper* passengers on my Hongkong flight traveled round trip from Manila to Washington—22,000 miles in 25 days. A traveling companion remarked: "We think nothing of it. Pretty soon we will be going around the world in half a day, then there will be no reason for going around the world."

Air currents affect the speed of *Clippers* and were a never-ending source of interest to the passengers out over the Pacific. The most speed the *Clippers* have ever made is 208 m.p.h., and then they had a 60-knot tailwind.

Between Guam and Manila we attained the top cruising speed of the flight—158 m.p.h. with a 23-knot tailwind. It didn't last long and the navigator observed: "We will slow up a little bit pretty soon as the winds are not so strong in the Philippines."

Between Guam and Wake we flew at 13,000 feet, and because of the rarified air we were able to travel 145 m.p.h. on only 40 percent of our horsepower. If we had flown at half the altitude, or 6,500 feet, we would have had to use twice as much horsepower.

It is much easier to do constructive work while traveling by *Clipper* ship than at a desk on the ground because it is cooler and there are practically no distractions. It is at least five times as easy to work on a plane as on a steamship. The diversions are few, even though the passengers are ambitious to be active.

Some of my flight companions wanted to play tennis aboard. Others expressed a desire to play pingpong on a miniature table. There was plenty of room and they wondered if the high altitudes would make the light pingpong balls weigh more.

These fellow sky travelers recommended that the *Clipper* ships install fans, light aluminum camp stools, dominoes and puzzles to amuse our flying successors. They contended you can spend five hours putting a toy elephant together.

Realizing they were in a pioneering field of air transportation the passengers took a great interest in thinking up new ways to make the flight to China even more enjoyable. They felt that the steward, after finding out who was on board, should introduce passengers at the beginning of each flight. A pamphlet might well be provided giving details about trans-Pacific flying and ports of call.

The Pan American Airways magazine should be available; they said, listing points of interest about the island airbases where the clippers stop each night. One lady, they cited, got off at Midway and stepped on a hermit crab before she knew what it was. That may or may not have been due to a shortage of guide books.

You can dream aboard a flying boat just as you do in your feather bed at home. My first dream on the *China Clipper* was while enroute from Wake to Guam. It was a mid-day nap at 10,000 feet. I dreamed that we had arrived at Guam and I was walking around the town of Sumay. It was late afternoon and I suddenly decided that I had forgotten to take my movies of Guam. I couldn't remember if we had a daylight stopover on the return trip from Manila.

I dreamed there were four people playing tennis on a nearby court. They were all people I recognized having seen in Honolulu or on shipboard somewhere. There were two young men, one young lady and someone's father.

"Yoohooing" over the ledge to their sunken tennis court I asked, "How long does the *Clipper* stop in Guam on its eastward voyage?" They looked up as if they had never seen me before and went on playing tennis.

Just then a New York stockbroker passenger came into the compartment of the clipper and spoiled my dream saying: "You certainly are havin' a nap. We come down at Guam in 20 minutes."

The flight to China made me tropics-conscious. I began all of a sudden to think in terms of how it would be when I returned to some coral strand to while away a few months or years. Then to quickly, in the space of a half dozen hours, fly up the Pacific Coast over a relief map of snow-covered mountains, brought me home with a thud. I changed from "the little grass shack" notion to at least consider the West, a nest and my favorite somebody.

Returning from Hongkong, Mt. Shasta with its shawl of snow had something in common with Midway and Wake, those tiny coral shoals in mid-Pacific. The similarity was not clear as I looked down at Shasta, the pride of California, but it must have been because the sands of tropical Midway resemble Christmas at dusk.

Golden Gate Bridge became as familiar as the nose on my neighbor's face after approaching it from all angles—

from Los Angeles to the south, from Seattle to the north, and from the Pacific to the west.

Aware that it is famed the world over, Golden Gate Bridge doesn't rant its feelings on foggy days and sing its joys on sunny days. It merely spans San Francisco Bay and quietly lets people gasp. It stands its prettiest as *Clippers* cross over its long bow enroute to and from Hawaii.

All along the Pacific Coast airliners plow up, over and through magnificent clouds, each trying to aggravate the proud landscape which spreads its beauty before the roving eye. Towns, orchards, trees and snow clamor for a share of the glory that is the West.

Land goes in for clouds more seriously than does the Pacific. Terrain manufactures heavy, thick masses of smoky clouds, whereas the ocean just fiddles around with billowy illusions. The mountains and valleys and villages really take their sky seriously.

Flying over land is different from flying over the sea for another reason. You can pick out a house and lot flying between San Francisco and Los Angeles, but you would sell it for a song over the Pacific. Your thoughts wander to the home and fireside if you are flying over thousands of homes where people live, die and are born. Over the ocean you think about countries, races, wars, peace, flowers, travel, fishing, swimming and excursions of all kinds. Over land you think of your personal problems, the things you have to do and the people you should write to.

You don't plan a trip to Europe while flying on the *American Mercury* from Los Angeles to New York. By the same token you don't worry about the debts you owe when flying across the Pacific. Your land affairs stay pretty much with you when you fly over terrain and your *laissez faire* vacation spirit casts a spell over you when you are flying the Pacific.

Probably this is due to your traveling companions. On *Clipper* ships there are assembled together on one flight people from many countries, persons who are bound for or from nations in all parts of the world. Many of them belong to different races and nationalities, and they have every sort of interest.

People on landplanes usually travel on business, carrying a brief case or a small suitcase and completing their trip in one jump on one day. Their minds are not removed from their life work, heartstrings and businesses long enough to sit with you and reminisce. You lack the feeling of wanting to slap a landplane passenger on the shoulder and say: "Well, pal, how goes it today?"

Having passengers introduced by the stewardess on landplanes would be uncalled for, but having the steward do so on a trans-Pacific *Clipper* would be an innovation and set the ball rolling at each takeoff.

Everybody on a *Clipper* settles back for a few days of fun and sheer relaxation. All the same steamer. Anybody who goes aboard a trans-Pacific *Clipper* doesn't expect to get back to his office or family for at least a fortnight and proceeds to unbend accordingly.

After flying in *Clipper* ships the land planes seem but toys, yet the transfer is challenging. In 17 short hours I was swept from coral reefs, flower leis and the sunshine of Hawaii to a temperate world of snow-capped mountains, crisp cool air and the majestic preening of San Francisco's skyline.

There was no more of the majestic Pacific's wide expanse. No longer the endless, flat but nonetheless beautiful expanse of the sea. Instead, the old familiar vari-colored earth had returned. The familiar sameness of cities, roads, forests and fields.

To go abruptly from a tropical island paradise and the skimming of thousands of miles of calm sea to an airliner flight over rugged mountains is breath taking. But glorious.

There is more to see flying over land, if you must think in terms of things you can reach out and touch. But nothing exceeds the thrill of flying over water and letting your imagination run wild. Anyone who has a dull moment in 12 hours, or five days, of ocean flying has lost his soul.

If I live to be a thousand I shall always be able to awaken any night and remember how beautiful the ocean, sky and sunsets are from high in the heavens over the Pacific—China bound!

END

Snakes

(*Continued from Page 24*)

snake into action, perhaps he could yet save himself.

He eased the control stick back just a trifle. The viper struck at it and attempted to sink its fangs in the metal. However the flyer noted with relief that the nose had come up enough to start the plane on an upward course. Frantically he watched the altimeter needle creeping past the numbers on the dial.

The air was getting cold and the snake, thoroughly aroused, was darting about the cockpit floor looking for a warm place to crawl into. The pilot himself began to shiver. for he was wearing only a pair of khaki coveralls and the temperature was getting close to the zero mark as 18,000 feet was reached.

The viper's movement became slower and slower until finally it lay uncoiled, seemingly in a stupor. The pilot prodded it gently with his foot and when it did not move he lifted it gingerly up by the tail and threw it clear of the plane.

END

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McFarland Model MPTG-3 Primary Training Glider—Absolutely A-1 perfect flying condition. Spruce construction. Hickory runner. Wire braced wings. Automatic-release towing hook. Launching hook. Shock-absorbing wing tip skids. 5" safety belt. Tailskid. Rubber bar foot stirrups. Handhold on seat and control stick. Large comfortable seat. Yellow wings and horizontal tail surface. Vermilion fuselage, cabane and vertical tail surfaces. License No. 18377. Built in May, 1937. Never cracked and always hangared. Priced for quick sale at—

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IDEAL'S GAS MODEL PLANE
5 ft. Winner of I.G.M.A.A. Trophy

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Canadian Glider Club

(Continued from Page 60)

swell in a primary, plenty of space and no rocks anywhere) at Choisy, Quebec, about 50 miles from town which, of course, our local bigwigs repeatedly ignore.

We now possess one primary glider, which cost us about $50 (no inferior materials used, all A. N. spec.), a trailer, an extra pair of wheels and axles and a secondary glider well under construction for our more or less advanced pilots, as well as all the component parts for a Heath, including a motor and propeller, excluding a landing-gear. No donations or great bargains have been received to date.

During our many ventures, dances, raffles, card parties, etc., we have lost members and gained some others. We started with nine and now we have ten. Our fees have now been increased to $2 per annum and 25 cents per month. Of course those things which cost real money and cannot be made by hand we have to acquire from generous members or friends.

Here's one thing about an interest in aviation. When we started there was only one member of the club employed, now there are several of our members working at a local aircraft factory where machines are made and conditioned, chiefly for the northern air routes. We believe that their interest in aviation was of great assistance in gaining employment. Of course, their training helps the club in constructional problems.

But we have experienced a general public apathy and with it a disinterestedness on the part of the local press (or vice versa), especially the aviation commentator. Of course our authorities could not hope to realize that people like us might possibly be sane. There's one exception to this though—a generous local air-minded tobacco firm whose interest is really appreciated.

Since our model days we have watched the progress of others in the columns of POPULAR AVIATION and always hoped to emulate them. We've started on our way now and who knows? Look out, Elmira.

END

Under the Hood

(Continued from Page 55)

seconds after the cockpit became cloudy with ash the outraged mechanical pilot began going haywire, diving and stunting the airplane in such a crazy manner that the man at the controls quickly caged it. The Sperry expert found later that the copyreader had clogged the pick-off valves.

Gwinn and Bear It . . .

Mr. Gwinn of the Gwinn Aircar company, Buffalo, is talking these days of building his little fool-proof biplane in job lots of 1,000 each. And yet he says he won't be able to sell the ship for much less than $5,000, even when produced in such quantities. . . . I'm afraid we'll all have to Gwinn and bear it but I don't see where he'll find a market for his machine at that price.

Odds and Ends . . .

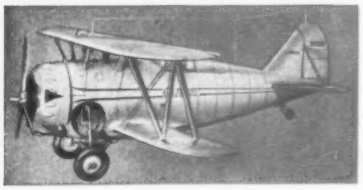
The sad inside story of Vincent Burnelli who sold his designs for a lifting fuselage monoplane to the Scottish Aircraft and Engineering Corp., is that the company has gone bust, and a receiver is in charge. He's now trying to sell the license to build the ship to the Netherlands Aviolanda factory at Papendrecht, Holland.

One of the busiest of the smaller manufacturers these days is Giuseppe Bellanca. . . . And the business is welcome after many lean days. . . . The plant is selling military aircraft all over the world, to Turkey, China, several South American countries, and even a few ships to Norway. "Fish" Hassel, the old Army instructor and north-passage-to-Europe flyer is Bellanca's ace salesman.

Incidentally, Bellanca is all set to return to the popular sport-plane market with some models somewhat less expensive than the old-time Bellancas.

END

COMET presents the GRUMMAN GULFHAWK



Exact Scale—1"=1'0". Wingspan—28½"

Amazingly complete, exact model of Grumman Gulfhawk which was made to order for Al Williams! All controls movable from cockpit. Retractable landing gear. Many parts furnished complete or semi-complete, shaped struts, tail block, wheels and leading edges; completed gas tank—even dressy decalcomania! Generous quantities dope, other materials..... $3.95
Postage 15c extra; none if ordered from your dealer.

ENTER GRUMMAN GULFHAWK CONTEST!

Featured by Scripps-Howard newspapers! $250 in cash prizes—added awards to winners using Comet kits.

THE COMET GAS MODEL

6' wingspan—Curtiss Robin

Leads the gas model field! First in flyability, completeness, and finished parts! Overall length, 46 in. Wt. 2 lbs., less motor. Takes any 1/5th or 1/6th H.P. motor. 3½" airwheels. Send 3c for catalog of Gas Model and other kits.

$6.50 less motor — $4.95 less airwheels

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Eastern Branch: 688 Broadway, New York.

SELLEY-TEX ALL FINISHED MOULDED PARTS

PATENTED

These new sensational moulded SELLEY-TEX Construction Kits build the finest and the most fully detailed authentic flying scale models ever produced. They stand alone—are actually years ahead of any model competition. SELLEY-TEX are the only kits that you can buy that do not require an expert to assemble and even novices with little experience easily and successfully build and fly SELLEY-TEX models.

50c
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18" WING
SELLEY-TEX AERONCA

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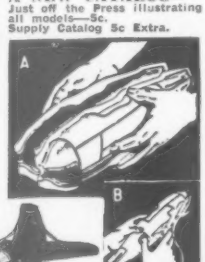
SELLEY-TEX BELLANCA RACER

A NEW CATALOG—
Just off the Press illustrating all models—5c. Supply Catalog 5c Extra.



EACH SELLEY-TEX CONSTRUCTION KIT CONTAINS
The necessary moulded fuselage sides, cowl, pants, bombs, motor. Sawcut propeller, scale propeller parts, formed wire hooks, scaled wheels, brass bushings, printed cut ribs on balsa, turned wood parts, tail wheel fork fittings, wire, para rubber motor, colored paper, authentic markings, colored insignia, cement, colored dopes and easy to understand plans, etc., and are packed in a beautiful sturdy box.

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20" Wing Span

100
15c Postage
GUARANTEED KITS

20" Wing Span

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THE LEADING STORES CARRY SELLEY-TEX. If their supply is exhausted order direct.

ALL FINISHED MOULDED ASSEMBLY KIT

SELLEY-TEX MOTH 1.50
Postage 15c

22" Wing Span

ONE HOUR BUILDING TIME TO ASSEMBLE THIS SNAPPY FLYER
HERE AT LAST IS A SUPER QUALITY model that is scientifically designed that will give amazingly long flights, either from the hand or off the ground. All parts of the Moth are beautifully moulded in the form of light, hollow shells, perfectly shaped and fully detailed. The fuselage shells are firmly fused together, forming a perfect crash-proof fuselage. All wing surfaces are moulded to the correct wing curves and are completely finished. Ask your dealer—if he can't supply you, send direct $1.50, plus 15c postage.

GUARANTEED TO FLY 200 FEET

MONOCOUPE 20" $1.25
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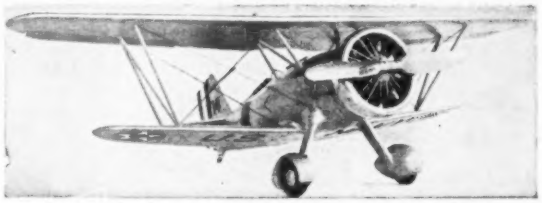
SELLEY MFG CO. INC. DEPT 412 1373 GATES AVENUE, BROOKLYN, N. Y.

NEW CURTISS F11C4 NAVY PURSUIT



28" Span. Length 20½". Weight 4 oz. 1" Scale

THE MOST EXCLUSIVE AND FINEST EQUIPPED MODEL IN THE WORLD
A special de luxe model, one of the most beautiful and finely detailed ever made, with its special exact scale 3¾" celluloid. 1000 H.P. type, Wright Cyclone motor, having aluminum push rods, cylinder fins, etc., like real motor. Also in set are 4" aluminum cowl ring, 9" carved sprucee semi-scale flying propeller, colored star and rudder insignia, 2" celluloid balloon wheels, silver dope, paint, black, red striping, Navy lettering, wire parts formed, axles, rubber motor, windshield, instrument board, flying wires, 4 aluminum step plates, aluminum wing walks, ready cut wheel pants, etc. All other parts printed on balsa. Detail scale drawing.
Construction Set complete, postpaid..... $4.50

41" LOCKHEED ARMY SPEED VEGA

41" Span. Length 28". Weight 8 oz. 1" Scale

This new model, built very strong yet light in weight, is practically crashproof and will out-perform any large scale model built. Rises from ground in 10 feet and flies over 650 feet. Set contains all parts printed on balsa, ready cut pant cores, 4¼" turned motor front, 11" steel type carved paulownia wood propeller, 2½" balsa wheels, tail wheel, formed wire parts, 26" rubber, 3 oz. yellow dope, 2 oz. blue, ½ oz. black, 2 oz. glue, cement covering, full size scale drawing, and all parts.
Construction Set complete, postpaid..... $4.95
ELF 1/10 H.P. Gas Motor may be used on this Vega model.

NEW NORTHROP A-17 ARMY ATTACK

24" Span. Length 17". Weight 2¼ oz. ½" Scale
Color yellow and blue

A new scale model of one of the 125 Northrops ordered for the U. S. Army. Set contains all parts printed on balsa, turned motor front, 7" carved propeller, insignia, wheels, set of colored dope, glue, and all parts.
Const. set in labeled box, postpaid..... $2.50

Brown Jr. 1/5 H.P.

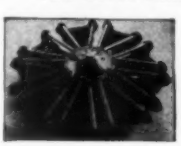
Long life motor with steel cylinder and piston for models of 5 to 8-foot span. ⅞" bore, 1" stroke. Complete as shown in illustration, ready to run.
Price..... $21.50

LOCKHEED VEGA GAS MODEL

82" Span. Weight with motor 5 lbs.

Set contains formers, ribs, tips, pants, etc., all ready cut to shape, 8¾" turned motor front, 4½" rubber tired air wheels, silk covering, glue, and full sized drawing. This is a dry set without liquids.
Price set, f.o.b. N.Y..... $17.50
THIS MODEL USES BROWN MOTOR.

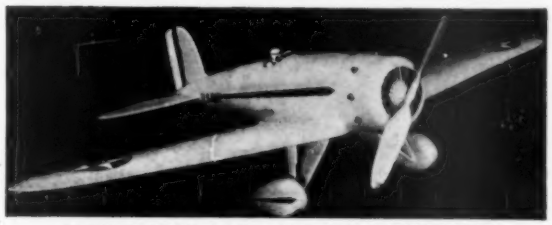
3¾" Celluloid Motor



The last word in an exact scale Wright Cyclone 1200 H.P. G-100 with aluminum push rods, cylinder fins, and all details.
Price postpaid..... $1.00

Note: In issuing money orders, use St. George, N. Y., postoffice

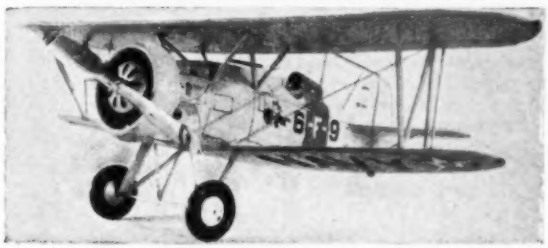
NEW LOCKHEED P23A NAVY FIGHTER



COMBINATION LAND AND SEA PLANE SET
32" Span. Length 20½". Weight 3½ oz. ¾" Scale

New 4-gun Navy fighter. Model will rise from land or water in few feet. Construction set contains fuselage and pontoon formers, wing ribs, tips, etc., printed on balsa, a 3⅜" turned cowl front, 2 instrument boards, colored insignia, lettering, windshields, 9" carved scale flying prop shown, 3 oz. silver paint, 1 oz. cement, ½ oz. black, 2 oz. glue, ready cut wheel pants, strong 2" aluminum wheels, 12 feet of rubber, and large 33"x44" drawing of land and sea plane. This is a sensational model and only one of its type in the world.
Construction Set in labeled gift box, postpaid..... $2.95
Above model is latest improved type, just out.

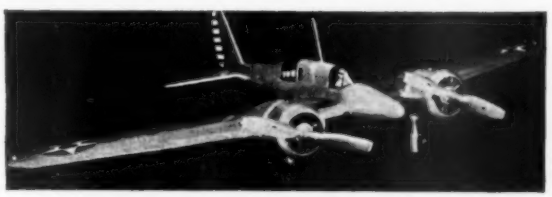
NEW BOEING F4B4 NAVY FIGHTER



22½" Span. Length 14½". Weight 2½ oz. Color, Grey, etc.

This is the finest equipped Boeing, F4B4 model in the world. New improved model exclusively equipped with new 3¼" special aluminum streamline tapered cowl ring, 9 cylinder celluloid motor with aluminum ventilator front, 8" carved varnished steel type propeller, printed out balsa wood parts, 2 oz. grey dope, ½ oz. yellow, ½ oz. red, paper cement, glue, formed wire parts, celluloid wheels, tail wheel, U. S. Navy lettering, colored insignia, and ¾" scale drawing. **Construction Set complete, postpaid..... $2.95**

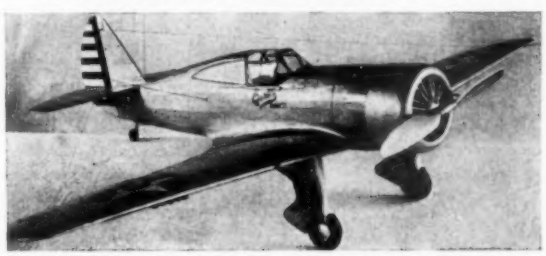
NEW CURTISS Y1A-18 ARMY ATTACK



38" Span. Length 26". Color yellow and blue

This new twin motor model has lots of reserve power on its two 8" props and flies very well. Set as all parts printed on balsa, colored paints, glue, etc., full size scale drawing, two 3" turned balsa motor fronts, wheels, two 8" steel type carved props, etc. **Const. set, postpaid..... $4.50**

NEW CURTISS ARMY HAWK 75 or P36



37" Span. Length 27". Weight 5½ oz. 1" Scale

Latest Army pursuit. Set includes all parts printed on balsa, 10" steel type propeller, 4" motor front, 3 oz. silver dope, glue, etc. **Set, postpaid..... $3.25**

NEW 1938 CATALOG No. 4—16 PAGES 7½" x 9½".

Catalog contains 6" photos of the finest models you have ever seen. Two cover etchings suitable for framing.

SEND 10c COIN

Note: Orders sent West of Miss. or Foreign add 20c postage

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MINIATURE AIRCRAFT CORP., 83 Low Terrace, New Brighton, New York

"They Said I Couldn't Fly"

(*Continued from Page 46*)

with myself for a long time—that I *do not* have double vision.

But—and here is the final touch to all this—I might have been wrong in all my assumptions. Maybe they *were* right and I was all out of whack and didn't know it. So, as I saw it, there was only one way to see for myself and that was to test my judgment of distance, ability to see on all sides of me, etc., under *actual flying conditions.*

I made a date with Tommy Fowler to fly with him in the ship. I told him nothing about what I had in mind. On the morning of October 3 I was at Curtiss-Reynolds airport at Glenview, Ill., where the Stearman-Hammond was hangared. Fowler had the ship rolled out, warmed the engine, then nodded to me to climb in beside him. He taxiied to the far end of the field, checked the engine, then took off. A few feet off the runway (a dangerous move in any other type of airplane) he suddenly threw the control wheel over to my side of the cabin and yelled:

"Go ahead and take her."

I took her. For 50 minutes I put that ship (and myself) through the proverbial paces. Takeoffs, climbs, banks, approaches, glides with and without flaps—and landings. In all that time Fowler had his hands on the controls I'd say about *40 seconds.* With only preliminary instruction on how to operate the flaps and throttle, I made five complete flights with that ship. Five takeoffs, five flights and *five landings.* Several times during this flying I made it a point to ask Fowler how my judgment and general ability were. (Fowler has been flying for some 20 years, so I think he can qualify as an expert in his line.) Not being aware of my real reason for doing all this flying, he was somewhat nonplussed, but each time he answered:

"Well, what do you think? I don't see anything wrong with your flying."

Then, after I had made my fifth landing, I asked him:

"In your opinion, could you *safely* solo me in this ship now?"

His answer satisfactorily ended the most conclusive test I myself could devise:

"Absolutely."

Then, as I taxiied the ship up to the hangar, I found even more evidence than I had expected. An oldtime pilot who had soloed more students than anyone in the whole Chicago area, walked up to the ship. Though I hadn't known it, he had been watching all my flying from the ground.

"Did you solo the ship?" he asked.

I told him I hadn't because I could not get a student permit.

"Why, every one of your landings was perfect. *I would solo you now.*"

Whose word would you take if you were in the same position? That of some men behind desks 700 miles away? Or that of a man (and another watching on the ground) behind the controls of an airplane that I had to fly, with him right beside me to pass judgment?

Lest my inevitable critics misunderstand, let me make myself clear on one point. I *do not* advocate the suspension of physical examinations for airplane pilots. I *do not* favor laxness in the examination of the heart, lungs, ears—and eyes. But, using my own particular case as an example, the Bureau of Air Commerce, though they have already passed final judgment on me, really knows exactly nothing about my *actual* ability as either a pilot or prospective pilot. Neither Mr. Fagg nor his Chicago medical emissary moved a finger to test me *psychologically.* No allowance whatsoever was made for my ability to overcome or accommodate for the "prism and diplopia" the examiner's instruments disclosed. It made no difference to anyone that I, like any other human who wears glasses, have adjusted myself to the point where today I *actually* can operate an automobile (or an airplane like the Stearman-Hammond) as capably as any other normal person.

On the other hand, if my eyes had passed, they would have granted me my license despite the fact that I might have been subjected to epileptic fits. All I had to do was tell the examiner I'd never had fits and that would be that.

It is obvious, then, that the Bureau of Air Commerce is grossly unfair to the average air-minded person who wants to fly. They can—and do—deliberately deprive him of the right to enjoy flying because of some insignificant technicality devised by a group of medical and legal "experts" whose practical knowledge of flying is limited, to put it mildly. If the Bureau of Air Commerce is to continue to use such sweeping powers, why don't they test applicants fairly? I heartily approve of a thorough examination of a person's vital organs. Obviously, a man with a weak heart should not only be kept out of airplanes but automobiles, roller coasters, handball games and toboggans as well. But Mr. Fagg should have no constitutional right to keep any average person out of a ship like the Stearman-Hammond because it already is a *proven fact that that airplane is safer to fly, under any but the most extreme conditions, than any automobile is to drive.*

I wonder how many air-minded Americans have been deprived of the right to fly due to circumstances such as mine? I am an average person who is no more supernatural than the milkman or the butcher. I want to fly my own airplane. Not a conventional ship like the majority of those produced today. But, when I can afford one that has the safety characteristics of the Stearman-Hammond, Gwinn, Waco "N", Waterman or any of these later "safety-planes", I intend owning one. And, so long as I do not prove a menace to society or endanger the lives and property of humanity in general, *I intend flying my own ship*—bureaucrats or no bureaucrats. I wear glasses—but so do a million other people in this country. I have been using this pair of eyes quite satisfactorily for many many years and my lenses are far from being an inch thick. I know *from actual experience* that I can safely drive an automobile and, no matter who tries to make it appear otherwise, I know *from actual experience* that I can safely fly these new, safer airplanes.

I'll not sacrifice my share of that famous (or is it infamous?) right to "pursuit of happiness" to any slide rule or theory, regardless of how much "brainwork" has been put into them. When, on the other hand, I can be *shown* that I am unsafe in an airplane, I will gladly stop flying.

For my safety as well as others'.

Editor's Note: Acutely interested in the problem brought up here by Mr. Karant, the editors of POPULAR AVIATION *would like to hear from readers on the subject. How many have run afoul of top-heavy regulations? Or, on the other hand, do you think Mr. Karant's is an extreme case? Your letters will be welcome.*

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Douglas DC-4

(Continued from Page 36)

When finally approved it was found that the engine instruments are grouped down the middle of the panel from the roof to the floor. Flight groups are on each side exactly in front of the men who will use them. On a raised platform in between the seats will be the throttle, propeller, mixture, carburetor and manifold heat switches and other such vital instruments within easy reach of either man.

The Sperry company has worked out an ingenious master control for the giro pilot which will be a standard instrument on the DC-4 and which probably will fly the plane most of the time. This master control resembles the stick in a smaller airplane except that it consists of a knob atop a short column. The column moves in two directions like a joy-stick controlling ailerons and flippers, and the knob can be twisted right or left to control rudder. Thus with this master control a pilot can fly the DC-4 as easily as he might fly a Travelair biplane or a JN4 trainer of 15 years ago.

There are eight radio units in the DC-4, with provision for more which probably will take the form of radio teletype printers or facsimile units, and the ultra-high frequency instrument landing receiver with special marker beacon receivers and others.

Comfort of the passengers is insured by luxurious chairs and berths which will be more comfortable than in a Pullman car and slightly larger. The main cabin is 7½ ft. high and 66 ft. long. Then there are smoking and dressing rooms and a private compartment at the tail of the ship. Beneath the cabin floor are two enormous storage bins and a third is beneath the forward washroom and the galley. By day 40 passengers can be carried while 28 can be provided with beds at night.

Although it was hoped at first that the DC-4 would have higher performance than the DC-3 and the DC-2, it now is believed that it will be about the same in all except cruising range. The new ship is expected to cruise about 190 m.p.h. at 10,000 ft. with a top speed of about 220 m.p.h. at that height.

Its range with full load will be 2,000 miles or about 10½ hours of flying time. Thus it would be able to make transcontinental trips with but one stop between the coasts if this were necessary. Its landing speed, under present Air Commerce Bureau regulations, may not be more thas 65 m.p.h. with full load at sea level. A flap which extends from aileron to aileron across the lower surface of the wings is expected to aid in obtaining this slow landing speed.

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Build Yourself a Baby Blimp

(*Continued from Page* 54)

As the diaphragm is distended, the pressure of the gas is increased accordingly. Automatic safety valves are installed to regulate both the gas and air pressure. The volume of air in the ballonet will vary, of course, with changes in temperature and altitude, which cause the gas to expand or contract.

Five degrees rise or fall in temperature will cause the gas to expand or contract, as the case may be, about 1 percent in volume. Its volume will also increase about 1 percent with each 375-foot gain in altitude. As it expands, air will be forced out of the ballonet when the pressure reaches the point at which the safety valve operates. Contraction will be compensated for by blowing in more air.

Incidentally, the maximum air volume in relation to the total gas volume has an important bearing on the ceiling of the blimp. For example, suppose the ballonet, when fully inflated, represents 15 percent of the total envelope capacity. Then, the theoretical ceiling would be 5,625 feet because, at that altitude, the gas will have expanded 15 percent, or enough to completely displace the air in the ballonet.

It might appear at first thought, that, since the volume of the gas increases with altitude, the lifting power should increase in proportion. That, of course, is not the case, because the density of the air becomes less with increasing altitude, thus reducing the lift accordingly. In other words, the difference between the weight of the hydrogen and air will remain about the same.

The ballonet also affords a means for controlling altitude, or even making descents, with little or no valving of gas. By increasing the volume of air, the pilot can reduce the effective gas volume, which, of course, increases its pressure but also causes a corresponding drop in lifting power. Since the weight of the compressed air is greater than the displaced gas, the buoyancy is thereby reduced. The center of volume of the ballonet, by the way, should coincide as nearly as possible with the center of buoyancy so that any variation in the air volume will not disturb the trim of the ship.

The pressure required to maintain the necessary envelope rigidity is comparatively low. About one-inch pressure, as indicated on a water manometer, will be found sufficient in most cases. When the ship is housed, the pressure may be even lower; just enough to keep the envelope from sagging at the bow and stern.

A hand-operated gas-valve must be fitted in the top of the envelope. Accompanying sketches illustrate the construction of such a valve, and show how a cloth cone is used to provide a gas-tight outlet for the pull cable. This method is frequently employed in airship construction wherever a movable cable must pass through the gas compartments.

Since the construction of the fins, rudder and elevators would follow the usual airplane practice, there is hardly any need for comment on these units. However, the method of attachment to the envelope requires a little explanation. A suggested scheme is illustrated in sketches. The fittings consist of a metal strip, covered on the underside with felt to prevent chafing of the fabric, with small attachment bolts brazed or welded on. The fittings may be attached to the envelope with a large cloth patch doped in place.

And that brings us down to the control car, which also carries the power plant. Similar to an ordinary lightplane fuselage in construction, it may be built of either wood or steel tubing, fabric covered, and as light as possible without sacrificing strength.

Ballast tanks for sand or water, controlled from the cockpit, would be installed in the rear of the car. As for the power plant, any of the smaller lightplane engines would probably be satisfactory. The motor shown in the drawings is a new 12 horsepower, single-cylinder, two-cycle type recently placed on the market. The total weight is less than 50 pounds.

The top speed would only be about 35 m.p.h., but any appreciable increase in speed would require such an enormous increase in power that the results would not be worthwhile. For one thing, the greater fuel consumption of the more powerful engine would not be in proportion to the speed increase; in other words, the mileage would be less.

Though the drawings illustrate a tractor installation for the engine, a pusher arrangement would, no doubt, be better from the standpoint of aerodynamic efficiency. However, it would complicate the tail control rigging somewhat. The cables would have to be run on pulleys mounted on outriggers at the rear of the car in order to clear the propeller. It is really doubtful whether the added advantage of a pusher installation would be noticeable, anyway.

Besides the usual airplane instruments, the car should contain two manometers, one to indicate gas pressure and the other for air pressure.

The method of suspending the car from the envelope is clearly indicated in the drawings. The suspension cables are ordinary ⅛ in. aircraft cables, with a turnbuckle at the lower end, terminating in a "D" ring at the upper end. The "D" rings, in turn, are attached to the fabric by four radiating strips of cloth tape, about 2 inches wide and 24 inches long, doped in place. This type of anchorage is called, in airship terminology, a "crow's foot" or finger patch.

Actual constructional details for the envelope itself will not be attempted here, since the job would be a little bit beyond the ability of an amateur. Like sail-making, the building of a dirigible envelope—even a small one—is an art, and not just a matter of cutting out pieces of cloth and sewing them together. Only an expert can handle the work satisfactorily.

Following is an estimated table of weights for the ship:

Structural weights—		
Envelope	210	pounds
Ballonet	20	"
Tail surfaces	40	"
Valves and accessories	10	"
Car and rigging	50	"
Motor	50	"
Total	380	pounds
Useful load—		
Pilot	150	pounds
Gasoline	24	"
Oil	6	"
	180	pounds

(*To be continued*)

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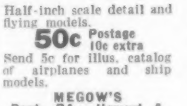

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FOR SALE—Hickman 3 POLB good Hisso, or trade for car or truck. Also converted Henderson and prop, instruments. Frank Fisher, Warrick, Montana.

IDENTIFIED OXX6 Swallow, good shape, redoped, dual controls. Miller overhead dual mags, instruments, $300.00 or trade for lightplane. J. Jacus. P. O. Box 136, Manville, N.J.

BABY ACE Fuselage, $15.00; Ford Conversion $25.00; Chev., $15.00. Wanted. 25x11x4. Airwheels. Matson Bros., Glenwood, Ill.

FOUR PLACE cabin biplane, same as new—$400.00. Tommy Scout, original equipment, $200.00. Will deliver either within reasonable distance. Take car in trade. Don Voge—Robbinsdale, Minn.

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HAVE YOU a sound, practical invention for sale, patented or unpatented? If so, write Chartered Institute of American Inventors, Dept. 119, Washington, D. C.

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MISCELLANEOUS

SKYWRITING—How to build equipment, materials used, etc. Complete work on subject, 70 page book, illustrated, the only information published, price $1. Aircraft Directory, Athens, Ohio.

113 AVIATION magazines, 2 air pistols; 1 leather helmet, new. All, $15.00 postpaid. E. Anthony, Texas City, Tex.

BLONDIN'S Aircraft Chart. Names, dates, records, and 94 pictures, $1.00. Blondin Chart Co., Box 34, Los Angeles, California.

COMPLETE plans, drawings for building man carrying Glider, 25c. Federal, Box 344, Dept. 11, Indianapolis, Indiana.

WANTED—Young man interested in aviation: We need a reliable person in each state. No selling or canvassing. Pay weekly. St. Joseph School of Flying. Dept. P, Municipal Airport, St. Joseph, Missouri.

NOTICE!

Special rate for readers (non-commercial) who wish to buy, sell or exchange airplanes, aeronautical equipment or supplies. 10 words for 50c, extra words 15c. Payable in advance.

Instruction

(*Continued from Page 20*)

one's name was drawn, his name would not be put into the hat again until every one of the active members had had his flight in turn.

This gave each one of them at least one flight a month, which was a great help in two directions. First, it would enable the student to decide whether he wanted to take up piloting more actively later on when he could afford more air hours and, secondly, it was a valuable coordination or application of the principles and instructions studied in the classroom*. Of course, many of the students went further and added some extra time to their regular 15 minutes a month so that they could pave the way to a pilot's license.

Although the subject of aeronautics has been entirely dropped from the curriculum of the Adult Education program of the WPA in Chicago at present, the three clubs fostered by the writer are still carrying on as best they can without an instructor, meeting weekly, giving papers on advanced phases of the course they have covered, planning their flying activities and, in the case of two of the clubs, carrying out a social and athletic program.

An intra-club basketball tournament has been successfully conducted between two flying clubs, with full cooperation from community centers having available gymnasiums. From time to time, groups were taken for tours through airplane and engine repair shops on several airports where the detailed operation of both flight and ground equipment were carefully explained by those in charge.

END

Valves

(*Continued from page 46*)

In the accompanying pictures and prints is shown this valve when used on the recent tests. The picture is a part of this motor which was cut up for display purposes. The method with which this valve fits into the head is clearly shown, also the ports on the intake side show fully eight times the area of the normal poppet valve opening.

The maximum air speed encountered in the exhaust was less than 100 feet per second at 4,000 r.p.m. The valve action is operated by a path cam which eliminates the springs required on poppet valves and increases the efficiency by opening and closing the valves more rapidly which acts like a shutter or gate.

These valves have been removed for inspection while the motor has been in operation, simply by disconnecting the sparkplug and removing the valve cap on the individual cylinder. At the present time plans are underway to equip a modern airplane with a motor of this type, so that a more exacting performance check may be obtained under aircraft conditions.

The use of this valve will allow the following:

(1) More and smaller cylinders, without loss of reliability.

(2) Higher speeds with more efficiency through completely scavenging and filling cylinders with less resistance and positive valve action.

(3) Refined combustion chamber, as valve is located directly over piston and does not require special pocket for valves.

(4) Higher compression ratios, as a sleeve valve will allow one more integer of compression with the same octane fuel.

(5) At no time will it be necessary to grind valves, as there are no seats, assuring full power at all times.

END

Answers

(*See page 44*)

WELL, we know you'd have to peek sooner or later. So dig your finger into page 44 and compare the questions with the following answers. The page on which the information pertaining to the answer can be found is indicated in parentheses:

1. May, 1932 (Page 33).
2. Local flying (Page 19).
3. Douglas (Page 26).
4. An amphibian (Page 11).
5. Its airport (Page 15).
6. Yes (Page 21).
7. $600,000 (Page 35).
8. Curtiss P-36, Seversky P-35 (Page 38).
9. Waco (Page 40).
10. Double vision (Page 46).

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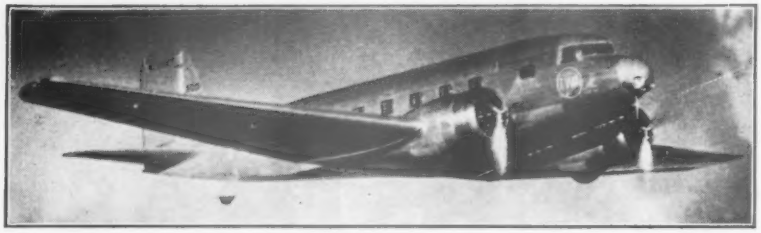

Can you answer these questions?

The compass reading is 230°, the variation is 18° E, the deviation is 7° W. Determine the true heading.

What would you do to get a plane out of a tail-spin?

What is the purpose of a condenser in the ignition system?

How is the torque of the propeller balanced in rigging a plane? Why is the vertical fin sometimes slightly offset?

What are 8 significant landmarks that are shown on good avigation maps which may be identified easily from the air?

What is the effect of having an adjustable stabilizer too high when landing?

What are the four basic cloud forms? What is the approximate altitude at which they occur? What flying conditions do they indicate?

In flying out of a small field, is a small or large propeller pitch desirable?

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